Founded as Metal Industry, January, 1903
by Palmer H. Langdon, 1868-1935

Published Monthly by
FINISHING PUBLICATIONS, INC.

Serving the electroplating and industrial coating fields with specialized monthlies and guidebooks since 1903. Companion publication, ORGANIC FINISHING.

381 Broadway
Westwood, N. J.
WEstwood 5-1530

Branch Offices

Los Angeles 14, California
742 South Hill Street
MAdison 6-5421

Hornell, N. Y.
19 Elmwood Place
Hornell 943

Member

BPA — Business Publications Audit

NBP — National Business Publications

Society of Business Magazine Editors

Devoted Exclusively to Metallic Surface Treatments

METAL FINISHING

AUGUST, 1954 VOLUME 52 • NUMBER 8

DEPARTMENTS

COMING SOON

The application of statistical quality control to plating processes, to help turn out a more uniform job consistently.

The use of the proper buff can save many dollars in polishing operations. Some of the less obvious factors concerning buffs are outlined in this article.

The determination of nickel in nickel plating solutions, wherein a stable reagent is employed instead of cyanide.

SUBSCRIPTION INFORMATION

United States and Canada $4.00 per year, other countries $8.00. Single copies 45c in United States and Canada, other countries 85c. GUIDEBOOK-DIRECTORY 22nd edition 1954 current, 570 pages 5¼ x 7⅞ $3.00. A copy of this book is included with subscriptions. Please remit by check or money order; cash should be registered. Request for change of address should reach us on or before the 15th of the month preceding the issue with which it is to go in effect. In sending us your change of address, please be sure to send your old address as well as the new one. It is difficult and often impossible to supply back numbers. Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.

ESTABLISHED 1903

VOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

VOLUME 52 • NUMBER 8 • AUGUST, 1954

How's Business?

Has anyone noticed that METAL FINISHING was one of the very few papers to refrain from reminding its readers during the past nine months that business could be better, to say the least? The reason was quite simple. We consider ourselves qualified to discourse on the subject of metal finishing but, unfortunately, we do not possess a suitable crystal ball to enable us to predict the future up-and-down trends of the business cycle.

What we went through has been called by the prognosticating gentry, leveling off, inventory adjustment, decline, dip, recession, and most of the other synonyms in the thesaurus. It all added up to the recognition that business was terrible and they really didn't know whether it was going to get better or worse, and when. Since this editor didn't know either, he wasn't much inclined to point out a state of affairs of which readers were fully aware.

Technical training has instilled in us a hearty suspicion of statistics, and averages always bring to mind the old cartoon showing a man floundering over his head in a deep spot while the sign on the shore of the stream advises that the average depth is 3 feet. If a multi-million dollar auto producer makes money while a few thousand small manufacturers are having difficulty paying their bills, we don't feel times are good, despite the average picture. Therefore, we prefer to go by what we see and hear during our regular visits to a fair cross-section of small industry. And, although we will not attempt to prophesy, we can, without hesitation say that the present picture is not at all a dark one.

There has been a noticeable improvement — enough to warrant optimism. Collections are slow but manufacturers are not living off their inventories; they are ordering steadily, although maintaining their inventories at a slightly lower level. Customers have to be sold, not tolerated, and prices must be shaved closely to make sales. It's this last which has been most difficult, but our experience during the last decade of what was generally a seller's market has been that a good many manufacturers and job platers needed to learn how to cut corners and increase efficiency. Now they are probably opening their eyes and taking stock.

Nathaniel Hall

Speakers' Table and Part of Large Gathering at Banquet.

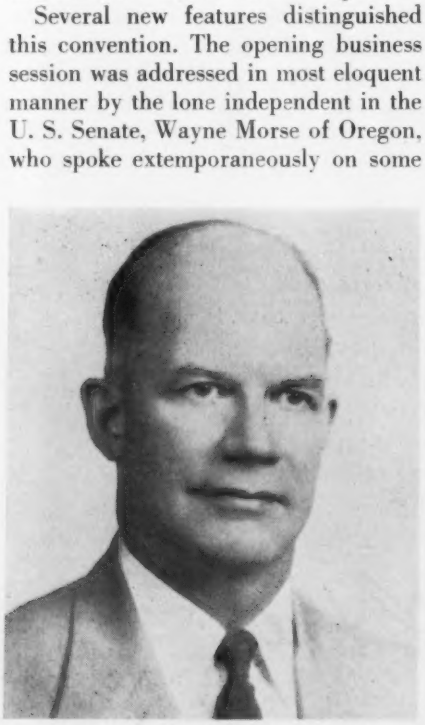
A.E.S. Holds 41st Annual Convention

RETURNING to New York after a lapse of 17 years, the A.E.S. staged a fine convention starting with the Sunday night reception on July 11th and continuing through the banquet on the 15th. The platers expected something big in New York, and they received it in good measure at the hands of George Schore, general chairman, and his hard working committees. Despite rumors that hot weather and mid-summer vacations would curtail attendance an impressive total of 1,440 was placed in the records which included two visitors from Europe.

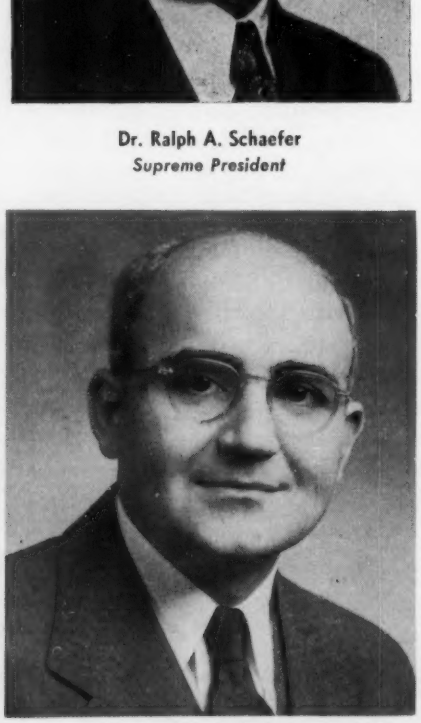
Several new features distinguished this convention. The opening business session was addressed in most eloquent manner by the lone independent in the U. S. Senate, Wayne Morse of Oregon, who spoke extemporaneously on some of the problems facing the country today. On Monday evening the International Fellowship party set a new record as successful party with a top-notch orchestra led by Vincent Lopez to spark the affair. Tuesday noon all men registered were invited to a general luncheon at which they heard two speakers, one on a technical subject of general interest, anodizing aluminum, and the other of a "relaxing" nature. The traditional windup banquet had a Broadway all star floor show of very high calibre.

Dr. Ralph A. Schaefer
Supreme President

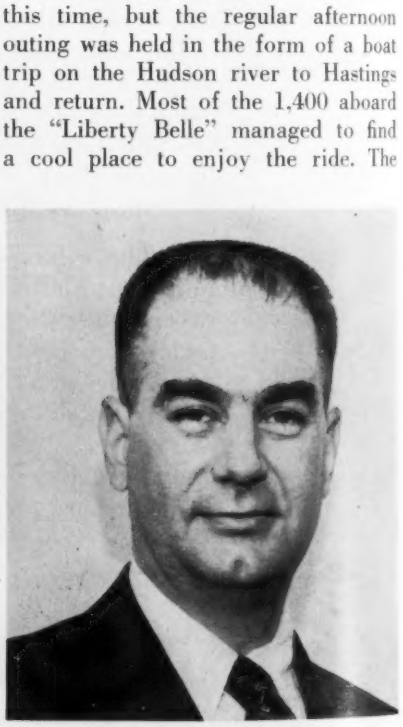
Plant visitations were ommitted this time, but the regular afternoon outing was held in the form of a boat trip on the Hudson river to Hastings and return. Most of the 1,400 aboard the "Liberty Belle" managed to find a cool place to enjoy the ride. The



Clyde Kelly
1st Vice-President



Dr. Samuel Heiman
2nd Vice-President



Francis T. Eddy
3rd Vice-President

General view of Open House Party sponsored by M.F.S.A.

high spot of the trip was a close up view of the sailing of the Queen Elizabeth, world's largest ship.

The ladies program, under the direction of Mrs. Barbara Schore, wife of the general chairman, included a theater party, a tour of the United Nations' buildings and a Plato party conducted by Joan T. Wiarda.

The Metal Finishing Suppliers' Association held their annual meeting on Monday noon with a luncheon attended by representatives of firms selling to the plating industry. Dr. Ralph Schaeffer, newly elected president of the A.E.S., spoke briefly on the subject of future Industrial Finishing Expositions, and after some discussion it was the concensus of opinion that such expositions should be held at intervals of not less than three years or more than five. It was suggested that where possible to avoid overtime and Sunday work in setting up exhibits that such shows open on a Tuesday. A moment of silence was called for the memory of several prominent men in the industry who had passed on since the last meeting — George B. Hogaboom, Robert S. Leather, Russell H. Pellington and J. J. Siefen. A message of sympathy was sent to the hospital where Wilfred S. McKeon, a charter member, is now convalescing from a heart attack. There was considerable discussion from the floor with regard to the wording of a resolution to be incorporated into a branch officer's manual of instructions being prepared by the A.E.S. After many changes, a resolution to localize the solicitation of funds (money grants) was adopted.

Dr. George P. Swift
Past President

New officers of the M.F.S.A. were elected for the ensuing year as follows: President, Manson Glover with the Ellis Allen Company, 5 Conn St., Woburn, Mass.; 1st Vice-President, Herman Struckhoff with Lasalco, Inc.; 2nd Vice-President, Joseph Duffy with Pennsylvania Salt Mfg. Co.; 3rd Vice-President, M. M. Beckwith, with Harshaw Chemical Co.; Treasurer, Thomas A. Trumbour with *Metal Finishing*, Westwood, New Jersey; Secretary, August P. Munning, Munning & Munning Co., 202 Emmett St., Newark 5, N. J.

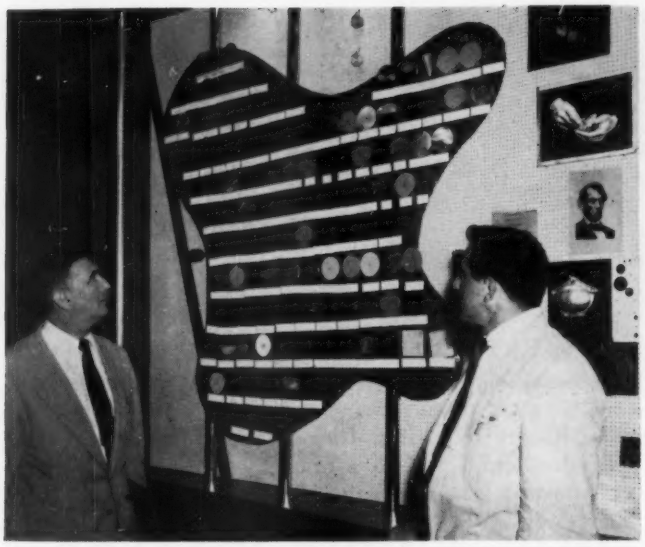
The trustees include Ray Ledford with Industrial Filter and Pump Co., Earl W. Couch with the Lea Mfg. Co., and George A. Stutz with the George A. Stutz Mfg. Co.

The retiring president who presided at this meeting, Al Braun of Braun Organics, Inc., was presented with an

Franklyn J. MacStoker
New Honorary Member

M. M. Beckwith
M.F.S.A. 3rd Vice President

Andre Waldberg
European Visitor

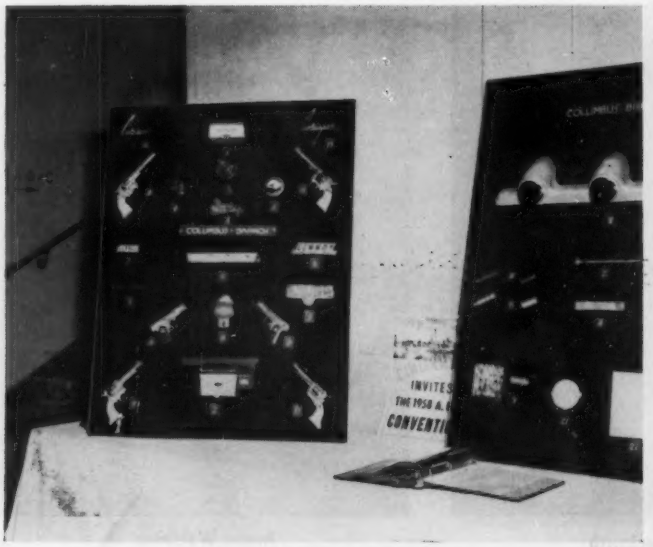


A display of electrodeposited coatings on all possible materials by the Master Electroplating Association.

Thomas A. Trumbour, general manager Finishing Publications, attending his 41st consecutive A. E. S. Convention, is shown with Nathaniel Hall, technical editor.

Jackson-Lansing Branch Exhibit.

Chicago Branch Exhibit.

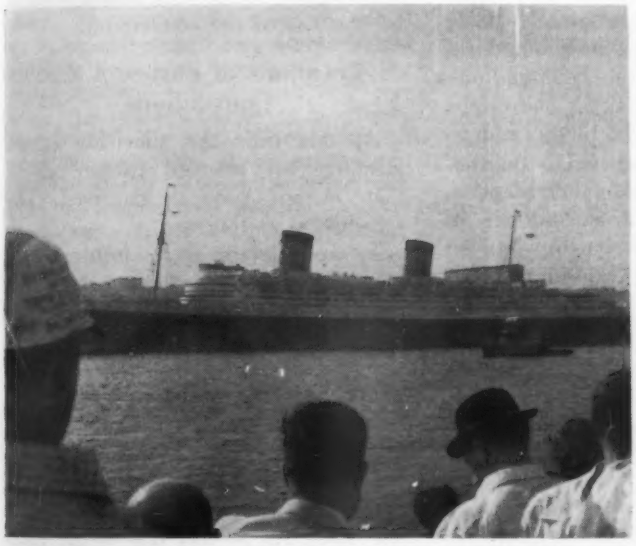


Columbus Branch Exhibit.

Frank C. Mesle, old timer and honorary member.

Al Braun, Braun Organics, presiding at the M.F.S.A. Luncheon.

Dr. Harold Narcus, Electrochemical Industries, Worcester, Mass.



Platers watch "Queen Elizabeth," world's largest ship, sail.

Delaware Belle approaches the George Washington Bridge.

Eugene Coombs, Diamond Alkali Company and General Chairman 1955 Convention, greets Mrs. Joan T. Wiarda, Finishing Publications.

Joseph Kushner, head Kushner Electroplating School, and Marvin Rubinstein, consulting engineer and author.

Manson Glover
President, Metal Finishing Suppliers Ass'n

inscribed gavel as were the other past presidents — A. P. Munning who continues in office as Secretary, and George L. Nankervis.

The National Federation of Metal Finishers held their semi-annual seminar in conjunction with the A.E.S. Convention, and on Tuesday evening staged a banquet attended by approximately one hundred members and guests.

At the annual meeting Mr. George Schore, general convention chairman, proposed and Mr. George Wagner seconded Franklin J. MacStoker for Honorary Membership in the Supreme Society. Mr. MacStoker was promptly elected by unanimous vote. He has served the New York Branch and the national society in various capacities since 1922 and went up through the chairs to the presidency. Mr. MacStoker is in charge of all plating operations at the Farrand Optical Company, Bronx, N. Y.

The present officers were moved ahead one step with Dr. Ralph Schaeffer becoming president; Clyde Kelly, 1st vice-president; Dr. Samuel Heiman, 2nd vice-president. Newly elected to the position of 3rd vice-president was Francis Eddy, assistant general superintendent of the Chase Brass and Copper Co., Waterbury, Connecticut and a graduate of Brown University.

The new president is a native of Grafton, Ohio. He received his education at Notre Dame, Western Reserve and is widely known for fundamental work in the practical development of plated bearings and as author of many articles on related technical subjects.

He is past president of the Cleveland Branch of the A.E.S. and has served on many committees on the local and national level. Dr. Schaeffer was associate editor of "Plating," 1946-49, and he has held many important national offices in the Electrochemical Society. He is vice-president of the Clevite-Brush Development Co., a subsidiary of the Cleveland Graphite Bronze Co.

Former top officers of the A.E.S., unlike those of some other organizations, continue to attend the meetings and take a part in the annual conventions. We noted the following past-presidents in attendance: Gilbertson, Candee, Wagner, Pinner, Fulforth, Johnston, Logozzo, Neill, Nixon and MacStoker.

The Membership Drive awards were made by Clyde Kelly. In the larger group Detroit took first place with a gain of 19½% to a total of 602½ members. We do not understand the "half member" in the computations, but it adds up to making Detroit by far the largest branch. In the middle-sized group Syracuse had a gain of 25%, and among the smaller branches Western Ontario had an increase of 27%. The entire membership had an average increase of 6% and now totals 6,451.

Dr. Heiman presented the awards for the branch exhibits of plated objects, which exhibits were arranged around the mezzanine of the Statler by George Cooperman. First place and a check for $100 went to the Columbus Branch. Second and third places went to Newark and Chicago respectively. In judging these exhibits, weight was placed on their educational aspects. Exhibits of a sales nature were not officially allowed. Firm honors went to three Connecticut concerns: Rockwell Silver, Ajax Mfg., and Torrington Mfg.

Peter Kovatis, Executive Secretary of the A.E.S. and Managing Editor of Plating, announced the new advertising manager of the magazine "Plating," H. George Burnley and the new technical editor, Lee Morrison.

A committee appointed to study the possibilities of broadening the scope of activities recommended that the society move slowly in this respect and favored doing more in the polishing and buffing divisions instead of the field of organic coatings, lacquers, etc.

Manson Glover wound up the business meeting in his own inimitable

Al Braun
Past President, M.F.S.A.

way by presenting the resolutions thanking all those who had a part in the success of the convention.

Locations of Future A.E.S. Conventions

At this time the sites for future meetings are planned further ahead than at any time in the past. The schedule is as follows:

1955 — Cleveland. No headquarters hotel. All meetings will be held at the Public Auditorium in conjunction with an Industrial Finishing Exposition: $25,000 worth of floor space is already under contract.

1956 — Washington, Hotel Statler. All bedrooms and public rooms here are air conditioned.

1957 — Montreal. Mt. Royal Sheraton Hotel. An all day trip to the Laurentain mountains will be a feature of this convention.

1958 — Cincinnati. All those who attended this year's convention will recall the strong bid made by the "Zinzinnati" delegation complete with appropriately costumed German band playing beer drinking songs.

1959 — Detroit. Hotel Statler. An Industrial Finishing Exposition will be held in Detroit's brand new Veterans Memorial, a part of the river front development. This will also be the 5th International Conference.

1960 — Los Angeles. No details available as yet.

1961 — Open, but Boston will make a bid for this one.

1962 — Open.

1963 — Atlantic City. "Down by the Sea in '63" will be the theme for the A.E.S. 50th Annual meeting. The Newark Branch is behind this proposal.

Finishing in the Heart of Industrial Europe

The Technical Picture in Belgium, England, France, Western Germany, Italy, The Netherlands, and Switzerland

By Joan T. Wiarda, *Sales Manager "Metal Finishing" and* Marvin Rubinstein, *Metal Finishing Consultant*

In response to a very healthy interest shown in foreign finishing by many U. S. manufacturers and suppliers, the authors, both long associated with the metal finishing field, recently took separate trips through Europe to investigate the field there. Mrs. Wiarda, for 18 years Sales Manager of this publication, and thoroughly familiar with its business and commercial side for over 31 years, concentrated on these particular aspects of the industry in these seven countries.

Mr. Rubinstein, a well-known Metal Finishing Consultant both here and overseas, made a somewhat more extensive tour. His articles on Israel, Turkey and Cyprus have already been printed here, while those on Yugoslavia, Greece and Spain will appear in future issues. His emphasis has been on technical developments, though both authors have overlapping qualifications in several areas of metal finishing.

In this issue, they have pooled their information to give our readers a broad cross-sectional view of the finishing field in these seven countries which constitute the heart of industrial Europe. All of their data have been checked and cross-checked, but in evaluating it, it is to be remembered that these reports were not gathered by living and working in the industry in these respective countries, but rather by conversing with suppliers, technical consultants and factory managers, to whom, incidentally, the authors wish to extend their most sincere appreciation for the courteous assistance received.

Following this article is a group of photographs of plating installations in Europe and a brief description of commercial difficulties and possibilities. Further illustrations of European plating equipment will appear in a later issue.

THIS side of the Iron Curtain, there are 22 countries in Europe, ranging in size from the tiny feudal principality of Monaco (area : 0.6 square miles; principal city: Monte Carlo) to large, populous democracies such as France. If, for the purpose of this article, the term 'finishing shop' is limited to those using a minimum of three workers, 75 gallon baths and 100 amperes of current, one could find about 11,000 plating and finishing shops in these 22 countries. This is only a few less than the number of shops in the United States, though of course overall production here is appreciably higher.

Roughly 90 per cent of these shops, however, are clustered in the seven countries covered by this article — Belgium, England, France, Western Germany, Italy, the Netherlands, and Switzerland. In finishing as in other industries, this is definitely the 'Industrial Heart of Europe.' Only in the Scandinavian Countries, which unfortunately the authors missed this trip, will many other noteworthy finishing plants be found.

These seven countries cover a relatively small area, 560,000 square miles or about that of Texas, California, and New Mexico combined. The total population is 214,000,000, about 30 per cent higher than the last U. S. census figures. There is, however, no relationship between the size of each country, its population, and the number of finishing plants it is blessed with. A simple breakdown shown in Table I will give the reader the idea:

These countries are listed in order of approximate degree of advancement in the field — a subjective opinion of the authors. All figures for numbers of shops are fair estimates, though there appears to be a wider divergence of opinion on Western Germany and Great Britain. In any case, these two countries have between two thirds and three quarters of the finishing shops in the countries covered. Productionwise, the monopoly is even greater. Both full and semi-automatics are included in the last column.

No one had a very good idea as to what percentage of these shops were job shops and how many were departments in larger manufacturing firms. A guess would be that the job shops constitute about 50 per cent of the shops in Italy, France and Belgium; from ¼ to ⅓ of those in Switzerland and the Netherlands; and slightly more than 20 per cent of the British and German shops.

Average Tank Sizes

As to the size tanks in use, here again there is extreme divergence. To get an accurate picture, it would be wise to divide the European finishing field into two sectors. The first comprises the huge majority of run-of-the-mill plating shops, job shops and specialty shops doing the bulk of ordinary finishing work. The second sector, consisting of only five per cent of the total number,

TABLE I.

Country	*Area*	*Population*	*Estimated Number of Finishing Shops*	*Approximate Number of Automatic Plants*
Western Germany	94,889	50,437,000	3,000 to 4,500	100
Great Britain	94,212	50,545,000	3,000 to 3,500	125
Switzerland	15,944	4,750,000	500	None
Netherlands	13,025	10,264,000	500 to 1,000	5
Italy	116,228	47,020,536	600	30
France	213,009	42,200,000	700	20
Belgium	11,778	8,639,000	200	Few

This building houses the laboratories and pilot plant of Germany's largest Supply House, the Langbein-Pfanhauser Werke A.G. located in Neuss (Rhein).

are those shops dealing with giant industries — automobile, aircraft, bicycles, typewriters, and the like. In the first group, the average size finishing bath holds 200 to 300 gallons of solution. Among the giants, plating baths average from 1,000 to 1,500 gallons. Chrome baths are naturally somewhat smaller, as are of course gold baths and those plating other precious metals.

Among the metals plated can be found just about every plate found in American plating shops. Copper, nickel, and chrome lead in popularity. There is also considerable silver, zinc and to a lesser extent cadmium plating. Due to its high price, the use of cadmium has lost adherents in Europe though not in as great numbers as in the U. S., since many of these countries have marine atmospheres and the substituted zinc deposits are not as good as their American counterparts. Tin is not uncommon, and precious metals as gold and rhodium find their usual uses. Hard chrome and some hard nickel are being used for engineering purposes. Almost all these countries use electropolishing, since this area is after all the cradle of its development.

Divergence from U. S. Methods

The following differences become immediately apparent. Acid zinc plating is more popular than it is here. There is much less binary alloy plating than in the United States, and practically no ternary alloy plating at all. Certain tin alloys find more use than in the U. S., but brass, alloy golds, and tin-lead (for bearings) are much less popular. New formulations are also notably lacking. Very few fluoborate solutions can be found and even fewer baths like the amine or pyrophosphate coppers.

The greatest differences are probably in cleaning. Trichlorethylene and to some extent perchlorethylene are frequently used, as are hot caustic and hot soda ash soak cleaners. Except in Germany, few emulsion cleaners were found. Electrocleaners were common but were usually cold in all but the large plants. A combination of an electrocleaning and copper flashing bath served a good percentage of the smaller shops. Reverse current cleaners were only occasionally seen and cleaning lines which include both a direct and reverse cleaner were very unusual. In the authors' opinion, water rinsing was usually insufficient, while spray rinsing was infrequent. The rule in drying was sawdust, hot air, or centrifugal. Hardly any water displacement liquids were found, and except in Germany and England only a few firms dried by means of infra-red or perchlorethylene.

Mechanical accessories were also at a minimum. As was seen in the chart above, less than 3 per cent of the plants have full automatic or semi-automatic equipment. More important, there is a significant lack of use of filter pumps, cathode rockers, circulatory pumps, air agitation, diaphragms, periodic reverse mechanisms and the like in the smaller and many of the medium sized shops. It is not that these devices are rarities, but rather that they are not considered standard equipment in the average plant.

Plant managers and foreman platers are not unaware of advances which have been made in plating techniques. They showed considerable interest in modern U. S. developments, but most shop owners seemed reluctant to obtain them for their plants, usually for financial, but often also for technical reasons. In short, it might be said that metal finishing in 90 per cent of the shops in the seven countries visited is presently at the stage where U. S. metal finishing was about 20 years ago. The old timers among our readers will grasp the picture.

We wish to emphasize, however, the extreme significance of the remaining ten per cent, for it acts as a leavening agent on the rest of the industry. It is, in a sense, the proving grounds for modern plating processes and methods, both American and European. It means that those shops 20 years behind will not require 20 years to catch up. And, it might well be pointed out that in certain specialized sectors, European finishing is even ahead of that in the U. S. This will be expanded as we give a more detailed description of finishing in these seven countries with particular emphasis on the better developed plants.

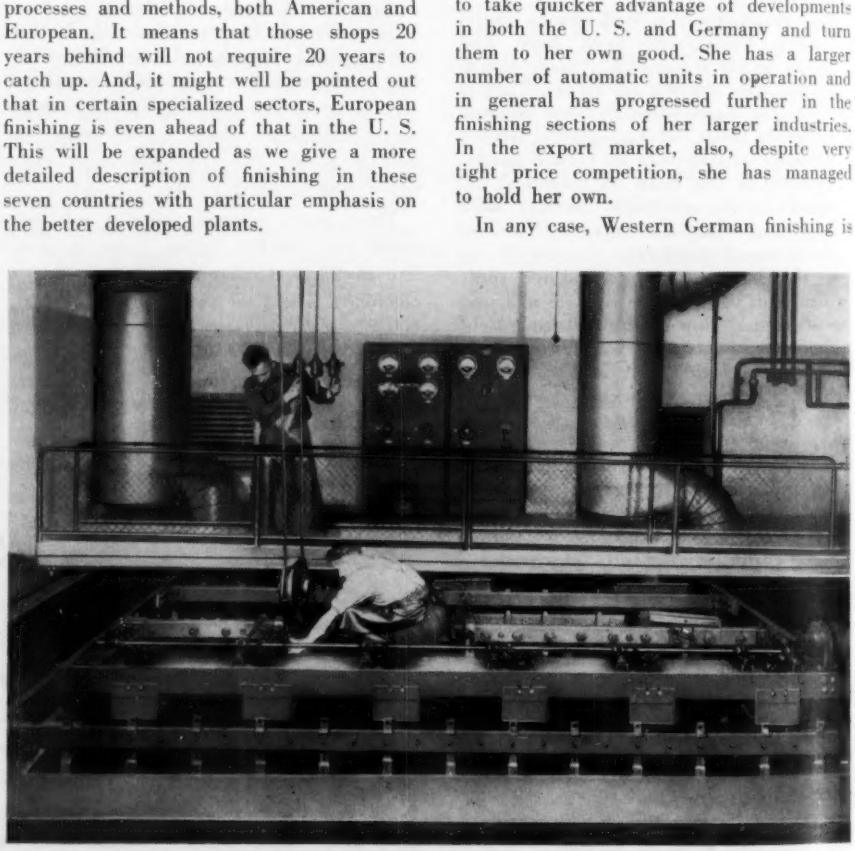
Western Germany

It might be said that only in Western Germany and in England did the authors get any truly favorable impression of real development in the field of metal finishing. Until World War II, Germany had the undisputed lead in the European finishing trade. This was true not only in Germany itself, but German methods dominated all of Europe's plating shops except those in England, and German equipment was used in most of them. This dominance extended to other continents as well — to the near and middle East, to the Orient and to South America.

The only competitor worthy of mention was England, and when the War made hash of Germany's industrial power, (and at the same time, a renaissance took place in British finishing,) Britain took over first place in European finishing development. On the plating equipment export market, the giant German supply house "Langbein Pfanhauser" gave way to "Canning, Ltd.," the equally huge British supplier. This continued for some time and it is only during the last five years that Germany, through intensive effort and development work, has once more gained a respectable place in the European finishing picture.

Today, it is difficult to assess properly the respective positions of these two highly industrialized countries. Western Germany has more finishing shops than Great Britain and the general development of the run-of-the-mill shops is higher. Recent advances in equipment and procedures have been more spectacular. However, Britain has managed to take quicker advantage of developments in both the U. S. and Germany and turn them to her own good. She has a larger number of automatic units in operation and in general has progressed further in the finishing sections of her larger industries. In the export market, also, despite very tight price competition, she has managed to hold her own.

In any case, Western German finishing is



A huge hard chrome installation at the job shop Gebruder Schoch in Stuttgart-Feuerbach, Germany. The man in the forefront is standing on an adjustable hoist for handling heavy parts. Note the huge exhaust pipes and control panels in the background.

A fully automatic "Karussell" type copper plating installation being used for bumper guards. This popular unit is designed by Dr. W. Kampschulte and Co. in Solingen, Germany.

at a high level. Of roughly 3,500 shops, only 100 or so utilize automatic or semi-automatic equipment, but many others, though not mechanized, use modern methods and have sizeable installations. Largest of the Western German plants and probably the largest fully automatic installation in Europe is the Adam Opel Motor Car Works at Russelsheim. This was installed by Friedrich Blasberg, (another large German supply house located in Solingen-Merscheid) according to designs provided by a U. S. firm. The plant utilizes 17,000 gallons of copper plating solution, 14,000 gallons of bright nickel and 5,300 gallons of chrome. One combination bright nickel-chrome unit is illustrated here. The chrome portion uses up to 30,000 amperes of current.

Of the shops mentioned above, about 750 are job shops. Largest job shop in Western Germany is the firm of Gebruder Schoch in Stuttgart-Feuerbach. Though not an automatic installation, this is an up-to-date shop employing nearly 800 workers, and running a large fleet of pick up and delivery trucks all over western Germany. Largest tank in use in Germany is 17,000 gallons capacity.

Specialty Shops

A number of interesting plating shops doing specialized work can also be found in Western Germany. Decca-Telefunken (Teldek) in Nortorf has 35 baths in operation electroforming phonograph record matrices. They are the largest firm in the field, providing both copper and nickel stampers for "Brunswick," Polydor," "Odeon" and a number of other German record labels. In Esslingen, the firm of Mahle manufactures piston rings on which they directly deposit hard chromium by a special method. In Germany, incidentally, can be found two of the largest hard chrome installations in the world. A firm called Finzler, Schrock and Kimmel located in Bad-Ems manufactures dental drills by codepositing nickel and diamond dust on the cutting surface. Other installations include processes as varied as the electrolytic manufacture of nickel anodes, the making of nickel flock and of metallic powders by means of plating, and vacuum deposition.

Recent German Developments

Much of the design in German automatic equipment is based on earlier American models. Primary exceptions are a number of rotary plating units (ringbader) particularly a very flexible, highly adaptable type known as a "Karussel" or what we would term a "merry-go-round." This unit, originally designed by Dr. W. Kampschulte and Co. of Solingen, can be found in many German plants.

It is, however, in the field of barrel plating that Western Germany has taken the lead over the United States. Most European plants use open diagonal barrels, though many horizontal types are found as well. Numerous improvements have been made on the handling, rinsing, loading and unloading mechanisms of horizontal type barrels. More revolutionary have been the development of two new types of barrels.

The first, known as the "Rotoplat" is a semi-closed horizontal type barrel with a large diameter as compared to its length. The advantage of that is visibility of the parts in operation, the need for a lower

Another Kampschulte unit, the "DeWeKa" basket type chrome plating barrel is extensively used for small parts like nuts and bolts in Germany and elsewhere.

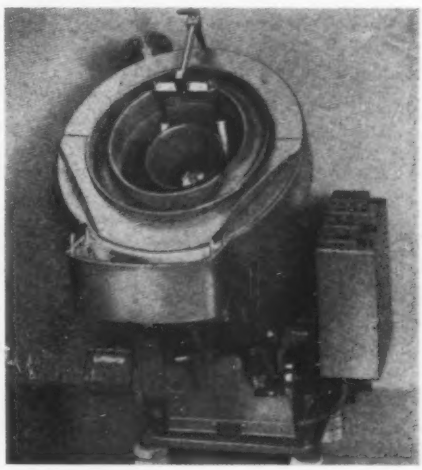
voltage, the large volume of solution and the large anode area always available. It also allows for an ingenious unloading device, which goes into operation when the direction of rotation is reversed. The second new type is a fully enclosed horizontal barrel with freshly filtered solution being constantly pumped through the barrel. With a special rinsing tank and air drying attachment, this unit could be operated much like the American automatic washing machine simply by pressing the proper buttons.

Of even greater interest to the American plater should be a variety of chrome plating barrels recently developed. Many makes can be found on the market, but three basic types are now in use. The first, known as the "DeWeKa" chrome plating barrel is more of a basket plater than a barrel. The parts, usually small, regular items like nuts and bolts, are placed in special flat wire baskets (mesh size varies with the size and type of part) which are gently rocked to and fro in the chrome solution. The anode, which swings aside for loading, is held close to the work just over the basket. An exhaust system and solution recovery device is also included in the apparatus.

The second is Langbein-Pfanhauser's type VCRD automatic chrome barrel. This is a unique machine completely automatic, where the small parts are loaded into a hopper and fixed amounts are conveyed into and through the barrel by a screw or worm apparatus and finally are unloaded by a wheel into a tray at the other end. The third new type of chrome barrel is known as the Chrom-Glockenapparat (bell apparatus) and is sold by Riedel and Co. in Bielefeld. It is an open diagonal type barrel, but does not have a tilt mechanism. It operates on a modified centrifugal principle and unloads by means of a winding arrangement. These three chrome barrels are a typical example of one sector of the finishing field where European development has forged ahead.

Though there are a number of other worthwhile development in German finishing, none are as of now as spectacular as the chrome barrels described above. A new sludge-free phosphating solution is worthy of mention. Known as the "Atrament" process, the solution gives a combined coating of ferrous phosphate and ferrous oxalate. Through the use of organic sequesterants and polyphosphates, the ferric phosphate and calcium sludges ordinarily formed during phosphating are kept in solution. This is a rapid phosphating process requiring from 2 to 5 minutes.

Another phosphating solution containing metallic phosphates, phosphoric acid and volatile solvents has been developed as a means of converting tight oxide and rust layers into protective coatings instead of removing them. In the cleaning field, an emulsion type cleaner known as the "Bondacid" process is used to simultaneously clean, degrease, descale and passivate parts prior to organic finishes or for in-process storage. Another unusual cleaning idea is the use of Pertrinol balls in trichlorethylene and perchlorethylene degreasers. These small plastic balls have about the same specific gravity as and are insoluble in the organic solvents. In operation, they swell up and by agitation scour the surface of the metal being degreased. They are very effective in loosening adherent and packed dirt and polishing compounds on the surface.



A second type of chromium plating barrel, the Verchromungs-Glockenapparat, is marketed by Riedel and Co. of Bielefeld, Germany.

A battery of fully automatic VCRD type chromium plating barrels at work at the Ionic Plating Company of Birmingham, England's second largest job plating shop.

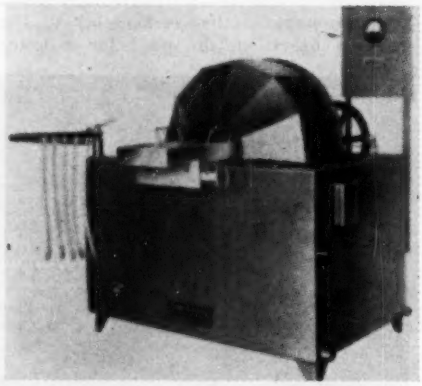
As regards new plating solutions, little new was found. Many firms were using U. S. bright nickel and high speed chrome solutions or similar German copies. One of the German bright nickels rather widely used has an interesting difference in that the brightener used can not be removed with carbon, so that it is possible to have continuous carbon filtration to remove other organic impurities. In the electroforming field, the authors found one other interesting process, the electroforming of pure nickel screen at the Friemann and Wolf Company near Duisberg. The process is photographic, so that the screen may be made in any size or shape mesh and in any thickness. Samples were seen so fine that they appeared to be solid strip until held up to the light. Equally important, the hardness, tensile strength and other metallurgical properties were very closely controlled. This firm also makes nickel and copper powders electrolytically.

What may turn out to be the most important development in Western German (or any other) finishing during the last few years is a process still in the experimental stage. It is reported that one German firm has been having great success in utilizing ULTRASONICS as a means of agitation and cathode film break up during bright plating operations. Unfortunately, the process is still under lock and key, so the authors were unable to see any concrete results. But, it is understood that bright, very fine grain, metallurgically sound deposits have been obtained by this method without using auxiliary brighteners.

No discussion of Germany would be complete without mention of the fine educational and technical library facilities found there. In addition to a three year apprentice system for working platers, there are numerous trade school and university courses for the finishing engineer. Finishing books and periodicals in all languages can be found in most of the principal industrial cities.

A few of the better schools are:

1. An electroplaters' trade school in Nurnberg (3 courses);
2. A Government school for workers in the metal industries at Iserlohn in Westphalia (3 years study);



A new design in plating barrels, the "Rotoplat" (Friedrich Blasberg, Solingen-Merscheid, Germany) has a large diameter compared to its width and unloads by reversing the motor. Note the way the anodes swing out on an arm during unloading.

3. The metal forming trade school in Solingen (2 years);
4. An art and work school of the united goldsmiths at Pforzheim (1 year); and
5. A Government trade school for workers with precious metals at Schwabisch Gmund (1 year).

There is presently no active electroplaters association in Germany, though one is now in the process of foundation. Various metallurgical and metal working organizations, however, do take an active interest in finishing and in some cases carry out finishing research.

A final word on supply houses. In addition to those mentioned previously, there are at least twenty other German firms engaged in supplying major items for the finishing field.

Great Britain

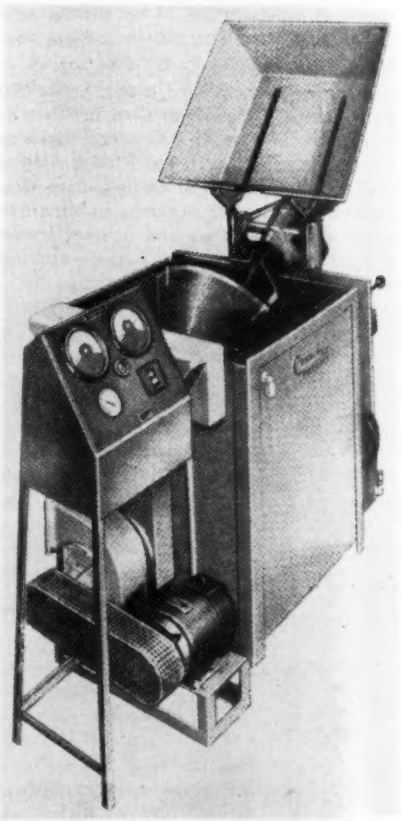
Across the Channel in Great Britain, equally varied activity and progress was discovered. There are somewhat more than 3,000 shops in Britain, including about 125 full and semi-automatic installations. These vary from tiny two man job shops to large plants employing more than 500 workers in the finishing departments.

Largest among these are plants doing subcontract work for England's large motor car industry, since many automobile manufacturers do not do their own manufacturing and finishing of accessories. A typical example, is the firm of Joseph Lucas, Ltd. With more than 10 factories and numerous subsidiaries throughout the Country, they turn out the vast bulk of electrical connections and accessories for the automotive industry. Their main plant in Shaftmoor Lane, Birmingham contains more than 12 full automatic plating installations doing nickel, copper, chrome, zinc and cadmium. Treated as a whole, they have without doubt Britain's largest finishing plant.

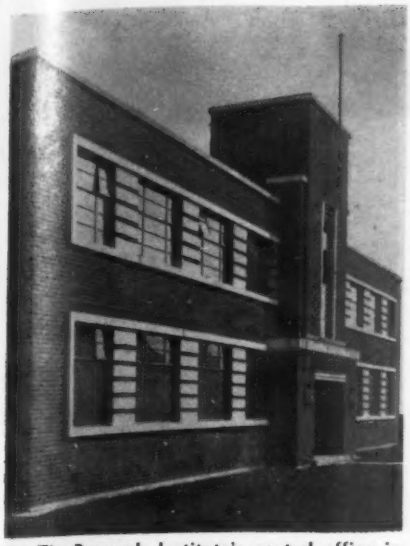
As a single shop, however, the firm of Wilmot-Breeden, Ltd., also of Birmingham, is probably larger. Also serving the motor car industry, they are Britain's largest manufacturers of bumpers and automobile trim. This shop as yet has little automatic equipment, preferring to operate by means of an overhead hoist rack-transfer system. Many of their tanks average 2,500 gallons capacity, while their bright and semi-bright nickel solutions alone total 60,000 gallons.

Probably the largest job shop in Britain is the firm of William Bate, Ltd., of Walsall. They employ some 600 workers, and their principal output is barrel plating, though they also do some still chrome work. Not quite as large, but better known, more modern and more varied in the types of work they handle is the job shop Ionic Plating. They are also located in Birmingham, the heart of Britain's heavy industry. These are two of approximately 650 job platers in Britain, most of whom are located in the midlands or the North.

The average size plating bath in Great



Canning and company markets this chromium plating barrel, known as the "Victor" type. Note the unloading device.



The Tin Research Institute's central office in Greenford, Middlesex, England, center of development work on tin-zinc, tin-nickel and other tin alloys.

Britain varies from 300 to 500 gallons for the jobber or small manufacturer. In the heavy industries, baths from 1,000 to 2,000 gallons are not uncommon. Probably the two largest tanks they have are a 14,000 gallon bath in the bicycle manufacturing firm, Hercules, Ltd., and a nickel tank of roughly the same size at Vauxhall, Ltd., a motor car firm.

New Developments

The 4th International Conference on Electrodeposition and Metal Finishing recently took place in London. It is interesting to note that 'modern metal finishing practice in Great Britain probably dates from the 1st International Conference in 1937. While it is true that the first commercially successful plating shop ever to operate, Elkington Brothers in 1840, was a British firm and many other plating discoveries, e.g. the first bright nickels (cobalt type) were made and started operating in England, until the mid-thirties, plating practice was relatively sluggish on the British Isles. Tried and true practices were strictly held to and new American production methods were "not suited" to their limited production.

During the 17 years between these two Conferences, however, miraculous progress has been made. Automatic equipment is there to stay. New finishing periodicals have started and others improved. Study teams were sent to America. Plating schools were opened. New research programs were under way. The net result is that Britain along with Germany leads the European finishing field, and — in a few items — has even forged ahead of us. Principal really striking advances are in the development of tin-alloy plating and in the construction of plating barrels.

Supported by the tin producing nations of the world, the Tin Research Institute, Greenford, Middlesex has done extensive original research in the development of tin alloys. Many of these alloys are now being used in England. That with the greatest practical application to date has been tin-zinc plating, a cheap and easily operable substitute for cadmium or zinc. About 25 firms in Britain are now using roughly 20,000 gallons of this solution (using 40,000 amperes of current) on motor car brake parts, nuts and bolts, electrical components, steel pressings, etc. Largest users are the Birmingham Small Arms Ltd. (who also make motorcycles) and the Electrical and Musical Industries, phonograph and record manufacturers associated with Columbia. The alloy has very easy solderability and has better corrosion resistance than cadmium under industrial conditions. A number of American firms have recently started using this process, which incidentally is only seven years old.

Tin-nickel plating, as a substitute for nickel plus chrome, is a more recent development — about four years old. About 1,500 gallons are now in operation in 6 British plants. (As far as the authors know, only one U. S. plant is presently using this alloy in a barrel plating set up.) The alloy, containing about 65 per cent of tin, was developed as a means of saving nickel, still in scarce supply. It has good corrosion resistance and an excellent throwing power. Most difficulties in control have been licked by now. One 'fault' which has held up more extensive use of this finish in Britain is that its 'light pinkish' cast seems to clash with the color of chrome plate. Subcontractors in the automotive and bicycle industries have been unable to use it for this reason, since each firm makes only a part of the plated accessories. Another trouble is that as of now no effective brighteners have been found.

Also primarily as a means of saving nickel, a modified bronze alloy (8 to 14% tin) has been developed by the London supplier, Silvercrown, Ltd. It is called the "Nickelex Process" and for the most part is used as an undercoat for chrome. The development of brighteners for this solution has also allowed its limited use as a finish in its own right, one particularly adaptable to chemical coloring as a final finish. One London job shop successfully operating 200 gallons of this solution is the Atlas Plating Works, Ltd.

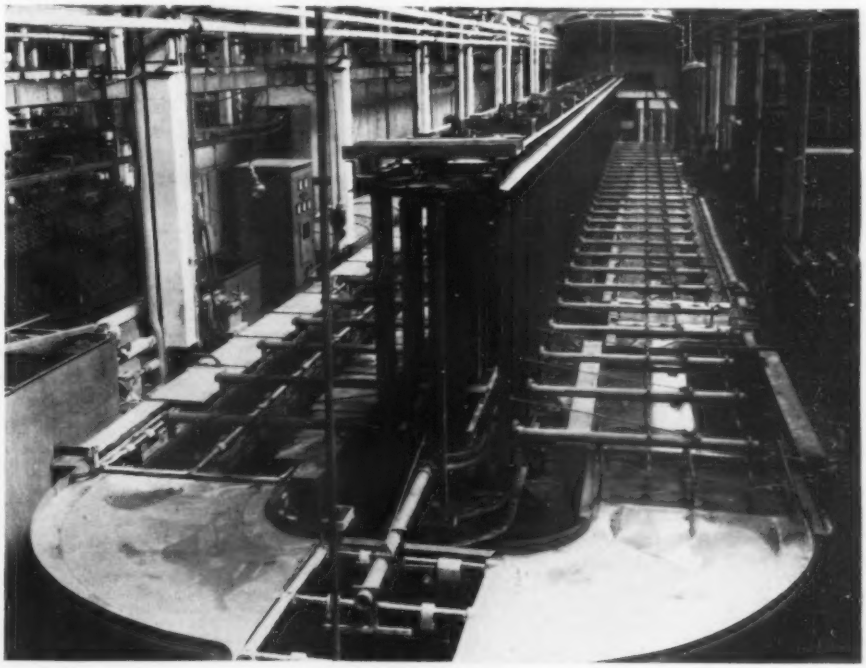
About 15 to 20 firms in Britain are doing speculum plating (42% tin; 58% copper) on headlight reflectors and on cheap household ware which is washed regularly. This is a very old process and relatively little advance has been made here, except for a brightening agent. Also in very limited use is the lead-tin alloy, which actually finds more users in the U. S. particularly on aircraft bearings.

Still in the semi-commercial stage is a tin-cadmium alloy, presently being developed by the Tin Research Institute firms in both Britain and America. Almost unbelievable salt-spray test results have been achieved with this alloy — over 1,000 hours as compared to 48 hours for tin and 120 hours for cadmium of the same thickness. It is believed that tin-cadmium (25% tin; 75% cadmium) is definitely the marine finish of the future. Major trouble at present seems to be the critical nature of the baths tried. One moderately successful patented formula follows:

Cadmium Fluoborate	32 fl. oz./gal.
Stannous Fluoborate	9.3 fl. oz./gal.
Boric Acid	2.7 oz./gal.
Ammonium Fluoborate	6.7 oz./gal.
Fluoboric Acid	7.8 fl. oz./gal.
Addition Agents	As needed
Temperature	Room
Current Density	15-60 Amps./ft.^{2}
pH	2.5-3.0
Anode Ratio	3 tin to 1 cadmium

A less critical formula is presently being tested in England.

Outside of tin-alloy developments, little new in the way of bath formulation has taken place in Britain. Bright nickel has made a considerable number of converts of late, but most of the baths used are U. S.



A fully automatic conveyor unit at the Societa per Azioni Eduardo Bianchi, an automobile and bicycle plant in Milan, Italy. This plant was installed by Hanson-Van Winkle-Munning through its European associates.

proprietary formulas, sublicensed to British suppliers. Two or three of the American bright nickels have captured the market there. American high speed chrome and bright coppers are also in use but to a more limited extent. However, most other up to date U. S. solutions have not yet made any dent in the British market. Electropolishing is also along U. S. lines.

On the equipment side of the picture, another major advance had been made in Britain. Barrel plating design has marched ahead. As in Germany, many new variations in handling equipment for horizontal type barrels have been developed, so as to make barrel plating more automatic. A barrel which loads through a hopper and automatically unloads into a basket when the motor is reversed has been released by M. L. Alkan, Ltd., of Greenford, Middlesex. Immersed diagonal type barrels have also lent themselves to automatic installations, as illustrated by the Canning automatic barrel plater.

Chrome barrel plating has followed German lines with a few variations. Several British firms are making a chrome barrel similar to the German VCRD full automatic barrel. Another type of chrome barrel now being made is similar in design to the Alkan barrel described above, except that it includes a rinse tank and has a built in exhaust. Another Canning chrome barrel of the diagonal-mesh basket type is illustrated. All of these include slight air agitation.

Most of the larger fully automatic plating units in Great Britain are built primarily along American lines and often even designed by U. S. suppliers through a British intermediary. As a means of cutting installation costs and for use with smaller runs, a popular small sized automatic has recently been developed. Normally, these units run about 28 feet long, are shipped in one piece, may be run pneumatically or hydraulically, and provide the proper sequence of operations for plating only a single metal. A typical unit of this kind is the EFCO Junior Automatic Plating Plant, marketed by the Electro-Chemical Engineering Company, Limited, though some other suppliers build similar units.

For two metal operations, such as bright nickel-chrome, it is possible to use the Junior for chrome and attach to it a semi-automatic extension for the bright nickel. These are joined by an interlock which eliminates manual rack transferring. Sometimes, a hydraulic loading mechanism is also attached which automatically transfers the work from a conveyor to the Junior and back to the conveyor again, making the operation fully automatic. The Junior and similar units will handle relatively large racks and can be installed in a room with an average height ceiling. The completely automatic combination described above is shipped in only three parts. Automatic units of this type have made deep inroads into the British plating industry and are becoming more and more popular every day.

Automatic polishing units, which seem to gain in popularity more slowly than the plating automatics, are for the most part designed along conventional American lines.

Education and Research

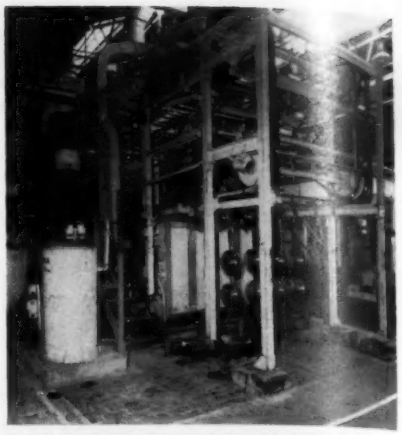
Both education, research and the exchange of information on finishing are rapidly on the increase in Britain. The Institute of Metal Finishing (formerly the Electrodepositors' Technical Society), local equivalent to the A.E.S., has become extremely active in recent years. At the recent International Conference they sponsored, no less than 14 important papers dealing with a variety of finishing subjects and research results were presented by British members.

Research is on the upsurge, not only in private engineering firms and suppliers but also in a group of research organizations. In addition to the Tin Research Institute, investigations can be found going on at the British Non Ferrous Metals Research Council, at Cambridge University, at the Imperial College of London and in the Government Ministry of Supply at Woolich as well as many others.

Organized educational courses in finishing are now also available to the British Finisher, as a substitute for the apprentice system previously in practice. The department of applied chemistry at the Northhampton Polytechnic in London now offers a three-year Metal Finishing Operative's course and an extremely comprehensive six year Metal Finishing Course.

In addition to those already mentioned, at least a dozen other firms are important suppliers to the British finisher. Additional photographs of their equipment are shown at the end of the article and in a later issue.

Before leaving Britain, it might be interesting to touch on two other interesting firms, one in the middle of a new development and the other because of its historical position. The first is the London and Scandinavian Metallurgical Co., Ltd. of London. Here can be found in operation an installation for making solid nickel and nickel-copper injection molds for the plastics and rubber industries. A number of molds being electroformed in this shop would be impossible to make any other way. In addition, no other method can duplicate the low cost and extreme fidelity of electroformed molds. Specially developed nickel solutions have made it possible to produce these parts, since ordinary nickels have too great a stress. Control methods are very rigid, and each mold turned out is stress free, has a specified hardness and is otherwise metallurgically sound. Photographs of molds made by this process are included.



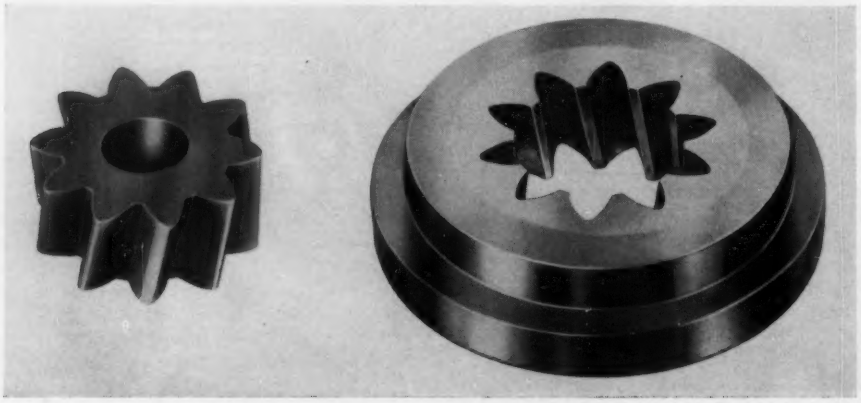
A fully automatic installation installed by M. L. Alkan, Ltd. at the Standard Motor Co., Ltd. in Coventry, England. This firm manufactures the Triumph automobile. (Alkan, Ltd.)

The second firm is Fesco, Ltd., a name probably familiar to old timers in the hard chrome field. This firm played such a large part in developing the processes now used for hard chrome and hard nickel build-up, that this type of work was once known to everyone as "Fescolizing." Though we don't hear the name as often these days, Fesco still operates three very large and busy plants in Britain — one in London, one near Birmingham and one in Scotland. Though the methods used there would no longer be fresh news to the reader, the authors visited the firm and are pleased to report that they are still doing business at the old standard.

One final word on Britain. American platers should note that they do not necessarily speak the same 'English' as their British brothers. A few differences can be seen below:

American	*English*
Bath	Vat
Rinse	Swill
Job Plater	Outplater
Gold Plating	Gilding
Buff	Mop
Motor Generator	Dynamo
Rheostat	Resistance Board
Chrome Floats	"Chroffles"
To touch-up	To doctor

And, five British Gallons are equal to six American Gallons.



Electroformed nickel die for helical gear wheel and a finished moulded part, made by London and Scandanavian Co. Ltd. in England. The nickel mould is held in place in a steel bolster using allen screws.

Switzerland

Going from German and British Plating to Swiss plating is like walking from a mansion to a doll's house, for though Swiss shops (like most everything in Switzerland) are neat and clean, their finishing operations are usually done on a very small scale. Thus, in discussing Switzerland, we must forget the size limitations for baths in the other plants in this survey.

There are about 500 plating shops in Switzerland, the largest of which is the iron working firm of "Eisenwerk Klus." The largest tanks range only from 250 to 800 gallons, but by far the vast majority are appreciably smaller than this. Many use only five and ten gallon crocks or small, open diagonal barrels.

This is more clearly understood when we realize that about 100 of these shops deal only with watch and clock parts. Another large group deals only with electrical and scientific apparatus parts and precision parts for the machine tool industries, mostly items of small or medium size, not mass produced. Roughly 150 shops are job shops, but even among these a good percentage of their work consists of refinishing individual household items. The Swiss are a thrifty people and take very good care of their possessions, many of which are expensive to replace.

It is not surprising, therefore, that the authors found no automatic installations in Switzerland. We were, however, pleasantly impressed by the enamelled kitchen-cabinet appearance of many plating units found in the more advanced shops. These units were well built and often had built in thermostats, control pannels, rinses, etc. In many cases, individual rectifiers were used with each tank. On the other side of the picture, from 20 to 25 per cent of Swiss shops operate under unsatisfactory conditions, using completely out of date methods.

Before the war, German methods had the greatest influence on Swiss plating, but today many plants look to England and America for new methods as well as for equipment. For example, from 150 to 200 Swiss plants are now using bright nickel plating, mostly sublicensed U. S. processes. It should be remembered, however, that the Swiss are surrounded by four Countries and that many of them speak principally the language of the Country on whose border they lie. It is not surprising, then, that other influences are also brought to bear, and that a great diversification in finishing methods exist.

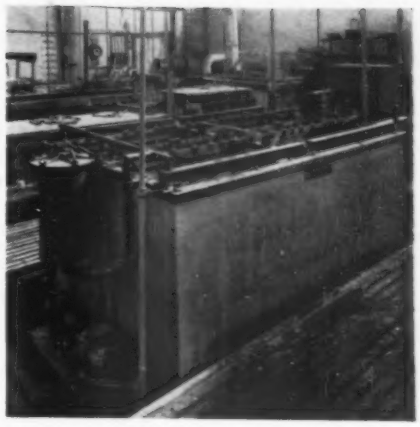
Copper, chromium, zinc and cadmium plating have also been improved lately, but not to the extent of the bright nickels. It is in the field of precious metal plating that the greatest progress has been and is still being made. Bright silver baths, for example, have been known and used in Switzerland for over 15 years. Dense, non-porous gold deposits, are the rule in the watch making industries. Rhodium and palladium also find extensive use. In general, much emphasis has been placed on getting pore free deposits, for on watch parts due to close tolerances it is not always praticable to deposit a thick coating to otherwise normal specifications. The techniques for achieving this are often part of the 'plater's art' as passed down from father to son, rather than due to modern procedures, though these are naturally of assistance.

One field of progress where Switzerland has it all over the rest of Europe is in the treatment of plating room wastes. This treatment is required by law in Switzerland, and most of the plating shops have been extremely cooperative.

There are few supply houses in Switzerland, since most equipment is imported. One large supplier worthy of note, however, is the firm of A. Reymond and Co. located in Bienne.

Shortage of Technicians

Chief lack in the Swiss finishing industry is qualified field technical personnel to assist in modernizing the field and to supervise modern plants once they are built. There are no plating and finishing schools in Switzerland, so most workers learn through working and consequently are defficient in both theory and in knowledge of modern developments. German and English technical schools are open to the Swiss, but as yet not enough men have undergone proper training in finishing.



A typical nickel plating tank at the Simplex Bicycle Works in Amsterdam, Holland. This was installed by the supplier, Danpoort N.V. in Rotterdam.

This same lack of trained personnel, incidentally, will also be found in France, Italy and Belgium to an even greater degree. There are undoubtedly many reasons for this, but one possible one may be lack of incentive. The authors noted one peculiarity in European finishing, the lack of Consultants in the field. While in the U. S. there are at least a dozen men operating as full time consultants (not to mention hundreds of part timers), we have noticed that in Europe finishing engineers have difficulty getting sufficient consultation work to make it a full time job — this in spite of a pressing need for technical assistance. Consequently, in most of these Countries there is usually only one or at most two men who devote themselves to full time consultation. They are almost invariably men with advanced academic degrees. Dr. H. Reymond in Switzerland, Dr. S. Wernick in England, Dr. Bruno Barratini in Italy, Dr. Richard Springer in Germany and Dr. J. Odekerken in Holland are typical examples. In most other cases, finishing firms prefer to go to the plating supply houses when they need advice or information.

A small still and barrel plating installation in the Swiss firm, Arnold Charpilloz, watch wheel manufacturers located in Bevilard. Thousands of tiny parts are regularly nickel plated here. Equipment supplied by A. Reymond and Co. S.A. of Bienne-Biel.

The Netherlands

For a relatively small country, the Netherlands have made spectacular progress in the metal finishing field during the past ten years. Like many of its neighbors, Dutch plating practice before the war was based on German methods, but of late owes its progress more to America and Britain.

There are 500 to 1,000 finishing shops in Holland, an excellent number for her size when compared to the figures for most of the other countries in this survey. Most of these, however, are relatively small firms, including about 225 job shops. Many items of modern equipment can be found in these shops, but only about five per cent of them have more than 20 workers and are completely modernized. Of these, only five utilize automatic installations.

Largest industry utilizing finishing is the Dutch cycle industry. At least a dozen firms manufacture and finish bicycles and parts, producing about 500,000 bicycles a year. Largest of these and one of the two largest shops in the country are the Gazelle Bicycle

factories. Another bicycle firm with a well developed finishing shop is Simplex Bicycle Company in Amsterdam.

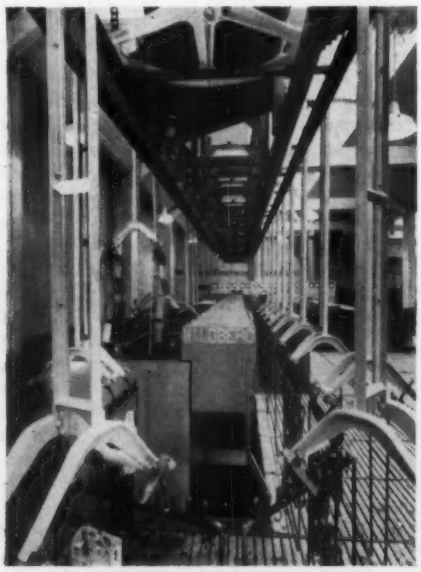
The second of Holland's giant shops is the Internationally known firm of N. V. Phillips in EindHoven. Most plating baths average about 400 gallons, while the largest in the country is no more than 2,500 gallons.

Other centers of finishing activity are silverware, hardware and typewriters. Electroforming is extensively utilized by the Dutch textile industry for printing rollers, incidentally a very commonly electroformed item throughout most of Europe. Many U. S. firms have subsidiary manufacturers in Holland, including Kaiser Frazer, and both Royal and Remington Rand typewriter.

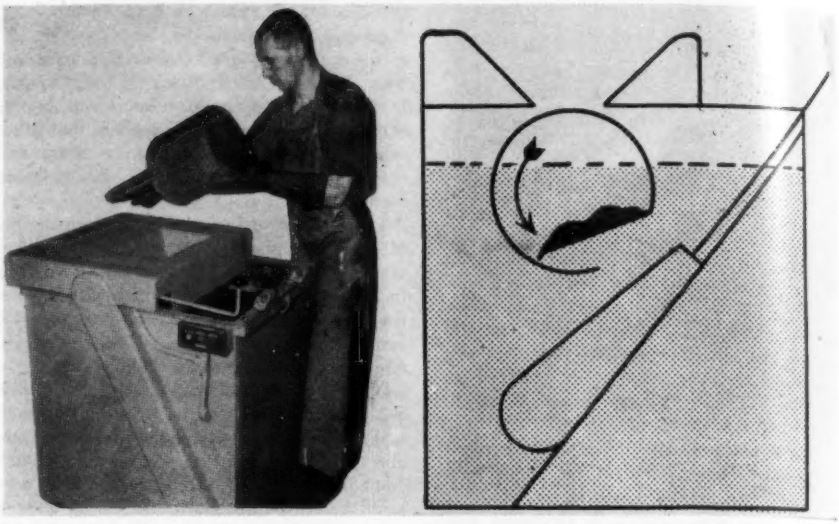
The figures given above tend to indicate that there are few major focal points of Dutch plating progress. Unlike the situation in most of the other countries covered where a few large firms were way ahead and the rest of the industry lagged, in Holland there seems to be a general healthy atmosphere of steady overall progress in finishing practice — perhaps a little slower than desired, but still progress. As in other countries, greatest advance has been made in the use of bright nickel solutions. More than 50,000 gallons of bright nickel are presently operated in Holland, with three quarters of these American solutions.

Little bright copper was found as compared to nickel, but Holland was the only country where a sizable number of firms are using periodic reverse bright coppers. There is also appreciable use of bright cadmium and zinc and a few users of high speed chrome baths, often based on American use. Precious metal plating finds relatively few adherents, however.

Credit for these advances can largely be laid at the door of the ten or so supply houses which service the country and a number of assisting organizations. These include the League of Job Platers, the finishing laboratories of the giant N. V. Philips Company, and the Institute for Cycle Development. Most of the suppliers actively represent U. S., British and German manufacturers. They and the other organizations maintain active liason with foreign finishing advances, have even gone so far as to send plating teams to study methods in the U. S.



Installed by Andre Waldberg and Co., this fully automatic installation at the Phillips Radio Company in Paris, does bright zinc plating on radio, TV and electrical parts.



An unusual type of plating barrel designed by Aklan Ltd. of England. The work is loaded through a hopper at the top and unloaded by inserting a basket into the solution and reversing the rotation of the barrel.

Two supply houses in Holland worthy of mention are Danpoort N. V. in Rotterdam and Plating-Chemie N. V. in 's-Hertogenbosch.

One final word regarding skilled finishing labor in Holland. Dutch platers all have to undergo an intensive apprenticeship for at least three years before they are accepted as competent platers.

Italy

If Italian finishing practice is thought of as a triangle with *Research and Development* at one corner, *Large Industries* at the second and *Small and Medium Industries* at the third apex, two of the three apecies could be said to be doing very well. Finishing research in Italy has always been of a high order. Most of the large Italian industries doing plating are now bringing their plants up to date. But, in the vast majority of Italy's 600 small and medium sized finishing plants, plating practice is still pretty primitive — still based on German methods of 20 years ago.

It was an Italian chemist, Brugnatelli, who probably accomplished the first electroplating in 1800, and numerous others of his countrymen have made subsequent development. At present, two Italian research centers are continuing the good work. Professors Cambi and Bertorelle direct the first at the University of Milan. The second at Milan Polytechnic, is headed by Professor Roberto Piontelli, well known both in Italy and abroad.

The fruits of Piontelli's work are presently being harvested in many an American factory, for it was he who did most of the original development work on nickel plating from sulfamate baths, baths presently finding good use in electrotyping and electroforming. He also plated a number of other metals from sulfamate solutions, including an excellent method for refining lead to a very high degree of purity. He developed Italy's principal bright nickel solution. Professor Bertorelle, founder of Italy's only plating magazine, did development work on superimposed A.C.-D.C. for Gold plating and on zinc-thallium alloys. Both of these men have done extensive other work of both a theoretical and practical nature.

Though only about 15 automatic installations can be found in Italy, nearly all of the giant Italian industries are presently modernizing or planning on modernizing their finishing departments. This includes Italy's giant cycle firms, Bianchi, Caffaratti in Milan and Rizzato in Padua, who each produce about 700 bicycles a day. Others are the Lancia and Fiat automobile factories, the Innocenti and Piaggio motor schooter manufacturers, the Borletti and Necchi Sewing machine works, the Carello Company who subcontract headlamps and the Olivetti typewriter and office machine company. Most of these have one or more automatic units.

Largest of these plants mentioned and one of the larger and more modern finishing plants in all of Europe is the Fiat plant located in Turin in the north of Italy. (Most of Italy's industry, incidentally is located in the North.) This plant produces 700 automobiles and numerous spare parts during an eight hour day. Four huge full automatic and two semi-automatic plants can be found there. They utilize more than 25,000 gallons of bright nickel solution alone, not to mention large copper, cadmium, zinc, tin, chrome, anodizing and galvanizing installations in tanks up to 10,000 gallons in capacity. The plant includes a battery of large diagonal barrels with an automatic drainage, solution recovery, and pump refilling system leading form a central reservoir. An up to date control laboratory completes the picture.

Were all Italian finishing shops like this plant, Italy would be in the forefront of European finishing. Unfortunately, the picture outside of this and related giant shops is not anywhere near as good. Five hundred thousand gallons of bright nickel solutions find use in the Country, and these baths are sometimes found in medium and smaller

firms. Outside of that, however, the bulk of Italy's finishing shops have much to learn from the firms at the top.

France and Belgium

Of the seven countries visited, the authors spent the least time in France and Belgium. Consequently, it is possible that they did not get the complete picture, but as a whole they felt that there was definitely much room for improvement in these two countries.

There are about 700 finishing shops in France and from 150 to 200 in Belgium. These include 15 French full automatics and about an equal number of semi-automatic units. There are two or three automatics in Belgium. One of the mechanical difficulties which had previously discouraged the use of automatics in France is a tendency to produce many items in two grades, an ordinary and a de-luxe grade. This means that the same item requires one thickness of plating at one time and a greater thickness when the superior quality variety is being produced. Thus, small batch runs are made even smaller. This difficulty has now been overcome through the use of a mechanical switch-over system, which enables the plater to change quickly from one timing arrangement to another.

Typical French firms with fully automatic installations are Projecteurs Marchal of Pantin (Seine), who make automobile headlights; the National Radiator Company in Clichy and the Singer Sewing Machine Company, both American affiliates; and Phillips Radio and the Parizot baby carriage company, both of Paris. Others are Peujeot in their bicycle factory in Sochaux and Lyotard who make bicycle fixtures in St. Etienne; the Renault automobile company in Bialancourt and the Simca automobile manufacturers in Nanterre. An automatic descaling plant can be found in the gas stove manufacturing firm Martin located in Revin. The Telemecanique Co. of Mainterre, makers of quality switches, have a modern barrel plating installation in their plant. Other high grade, though not automatic, installations can be found at air line repair depots like Air France near Paris and Sabena in Bruxelles, Belgium as well as at the French Line repair shop at LeHavre.

The "Dalic Process," a new French development, is here being used to build up a worn shaft at the firm "Somua," manufacturers of heavy industrial equipment. The solution is held in the "brush" in the operator's hand and is renewed regularly by dipping. The shaft rotates during plating.

Resistance to New Methods

It should be noted that among the larger, more progressive firms, some very fine finishing shops were found. However, the unfortunate thing is that such firms only cover about seven or eight per cent of the total number. In the remaining shops, a decided inertia was encountered, and this inertia was holding back more rapid acceptance of up to date methods.

This inertia is not the fault of the suppliers. There are six general plating suppliers in France, the largest of which are the Andre Waldberg Co. and the firm of Grauer & Weil, both in Paris. There are also several firms who provide individual items needed in the trade. These firms have been pushing new equipment and new methods, but have had to move slowly. In Belgium, ten supply houses face a similar problem.

Nor is it the fault of the research scientists. Much active research has been going on in France, and some French discoveries are now seeing much active service in the United States. A typical example is the development of electropolishing, a field initiated and largely developed by French electrochemists.

Probably the greatest fault lies with many factory owners, who seem to fear new methods. Their fears stem from a very basic, inbred conservatism but also from a more practical consideration. This consideration is that until recently wages in these two countries (as well as in the other five, but to a lesser extent) have been so low that factory owners found it impossible to amortize the great cost of automatic and other modern equipment through any appreciable savings in labor costs. Recent increases in the cost of labor and special payroll taxes have somewhat changed the situation, and orders for labor saving methods are beginning to roll in.

Another concrete difficulty is that both France and Belgium are short of sufficient practical personnel with a knowledge of modern plating methods and control. A third difficulty has been in a lack of standards for the finishing field.

This last trouble has been corrected. A new set of standards based on plating thickness has recently been investigated and established in France. Along with this, directions for proper tests to maintain these standards are now being given. It is hoped that this step will give a boost to the industry.

In the field of new development, one item caught the authors' attention. This is the invention of a mature, high speed brush plating process by a French electrochemist named Icxi. Known as the Dalic Process, this development is being used extensively not only in France but in Britain and other European countries. Using metallo-organic solutions of an unorthodox composition, the process manages to get current densities previously unheard of, in some cases up to 5,000 amperes per square foot of contact area. More details will be given in a future article.

Some other developments in alloy plating have not proved as successful. A ternary alloy of zinc-cadmium-mercury was extensively tested, but was found to affect adversely the mechanical properties of the base metal, probably due to the mercury. A novel zinc-titanium alloy also made very little progress.

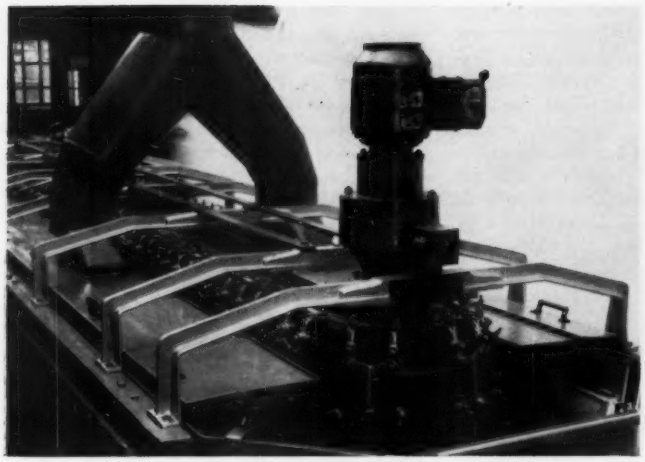
The authors sincerely hope to be able to report other such concrete advances on their next visit to France and Belgium.

Metal Finishing Widely Used

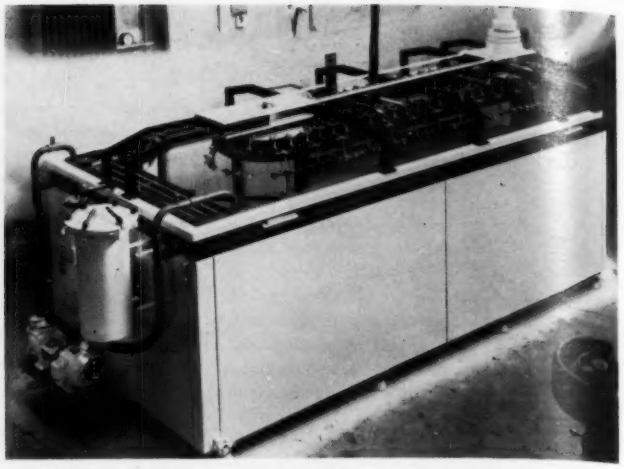
Though there is a technical journal in France dealing with finishing operations (as well as three in England, two in Germany and one in Italy), the authors found *Metal Finishing* extensively used and respected by French finishing men as well as by those in the other countries visited. Complete files can be found in technical libraries like the Maison de la Chemie in Paris. Many firms subscribe to translation services like the one at the Documentation Center of the National Center of Scientific research, also in Paris, so they can get the most important articles in translation. And a large number of firms subscribe directly, since they feel that the Recent Developments and New Equipment sections as well as the advertising are equally valuable to their work.

One man showed the authors a large clipping file of equipment illustrations, entitled *Moderne Galvano Fabric*. It was all part of a plan for future development of his plant. A dream? Perhaps, but he really lives with his idea and has, he said "during the past five years replaced many pieces of equipment." By that, he meant that he had replaced an illustration with a later model or another manufacturer's design. It is the authors' hope that by finding means of more actively marketing American finishing products abroad this man's picture book can be turned into a real, live *Modern Finishing Plant*.

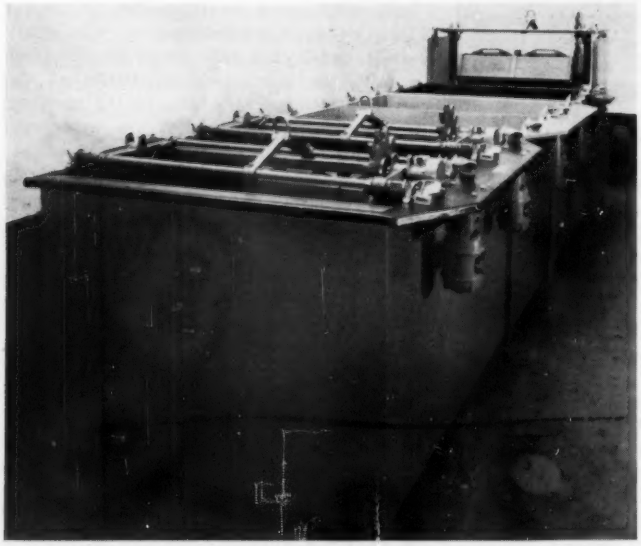
See the following pages for illustrations of foreign installations.

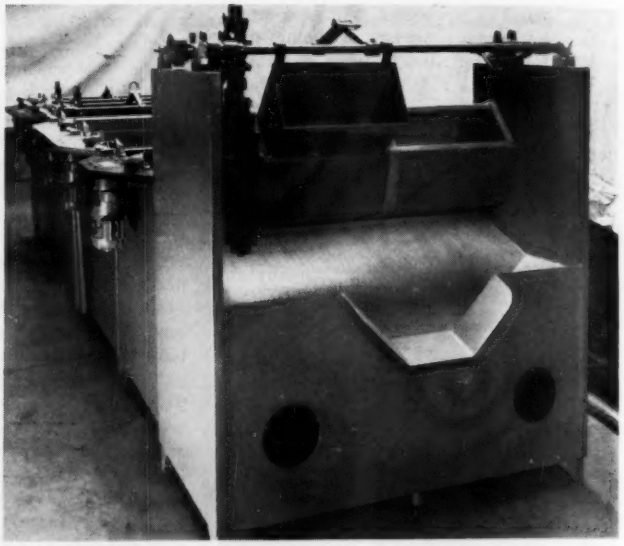


Sectional view of a semi-automatic copper plating installation (Kampschulte).

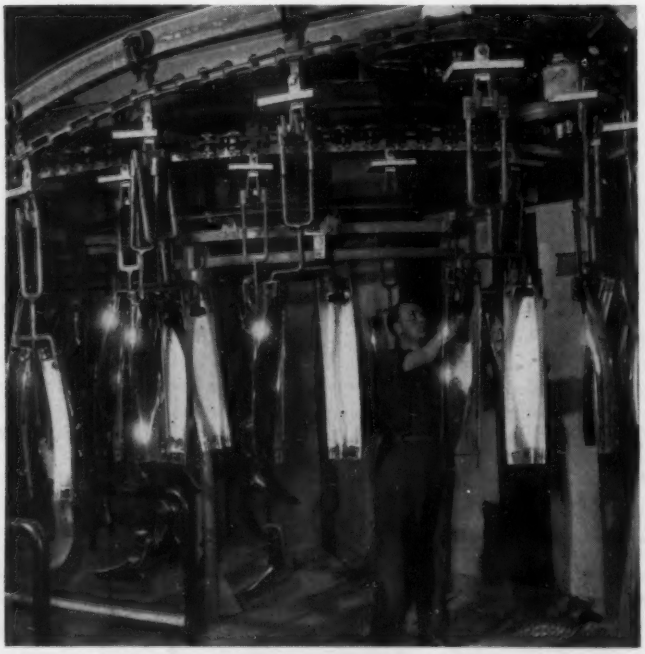


Semi-automatic installation for bright nickel plating (Kampschulte).

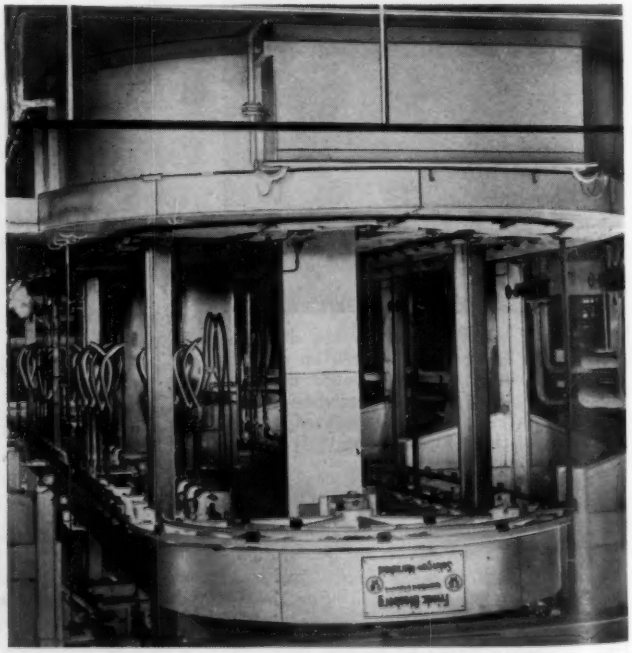




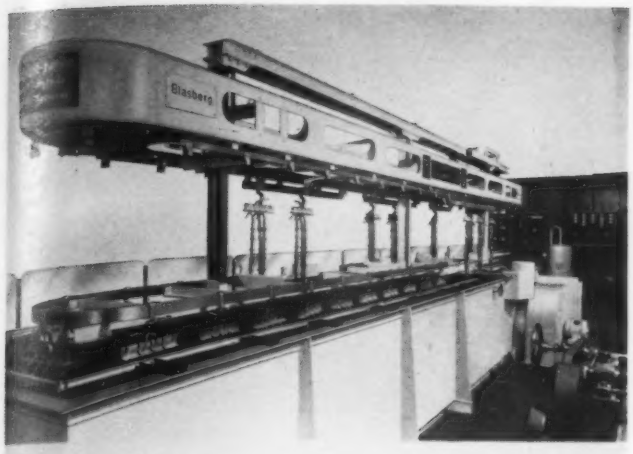
Multiple barrel plating installation for small articles as seen from loading and unloading ends. For nickel, copper or zinc. (Kampschulte).



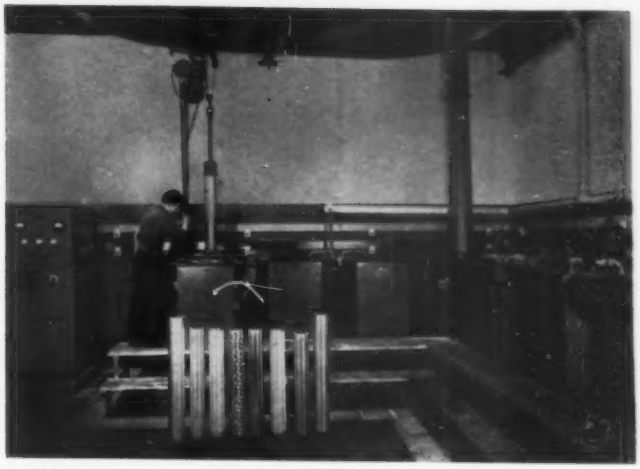
Part of the fully automatic plating plant of the Adam Opel plant in Russelsheim (Blasberg).



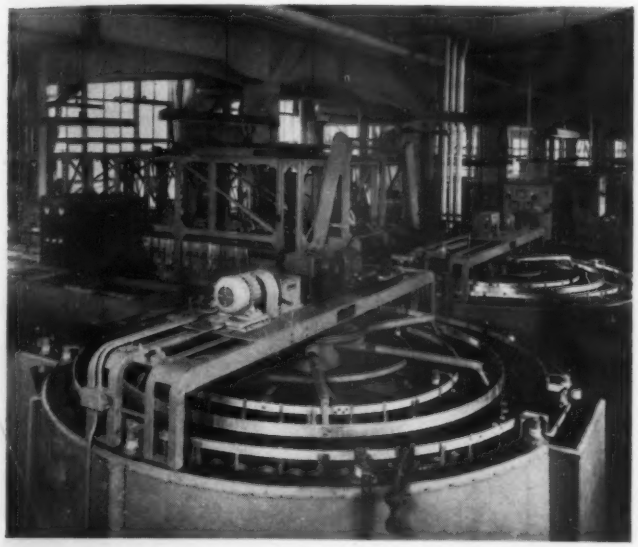
Other end of the fully automatic Adam Opel plant for plating automobile parts (Blasberg).



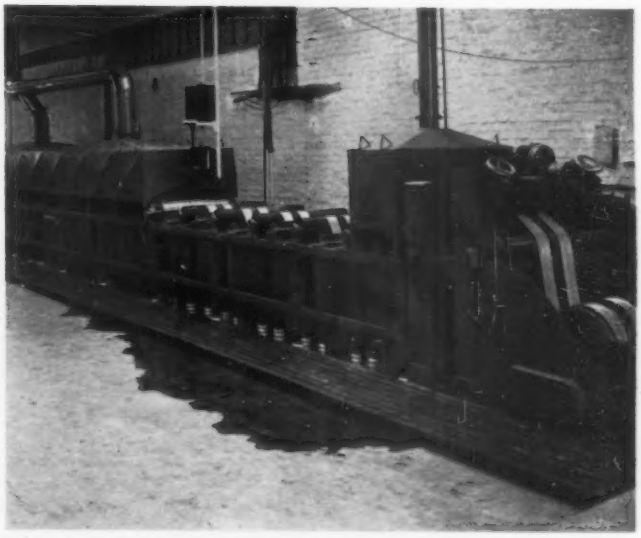
Popular type of full automatic being used in Germany and Great Britain (Blasberg).



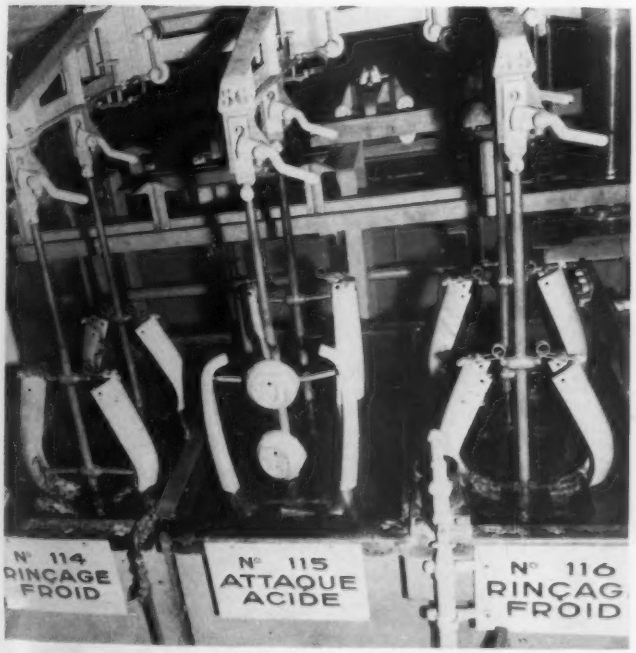
Installation for chrome plating on electroformed copper rollers for textile printing (Blasberg).



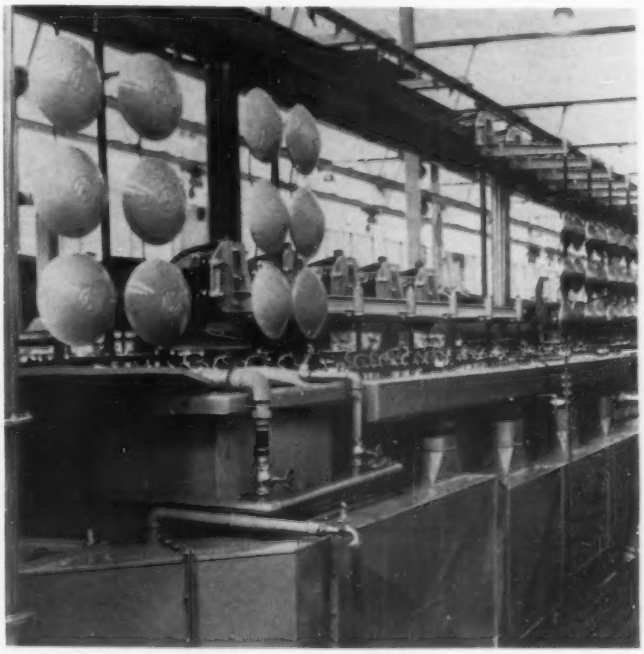
Fully automatic circular baths and plant for silver plating holloware at the Wurttembergische Metallwaren Fabric in Germany (Riedel & Co.).



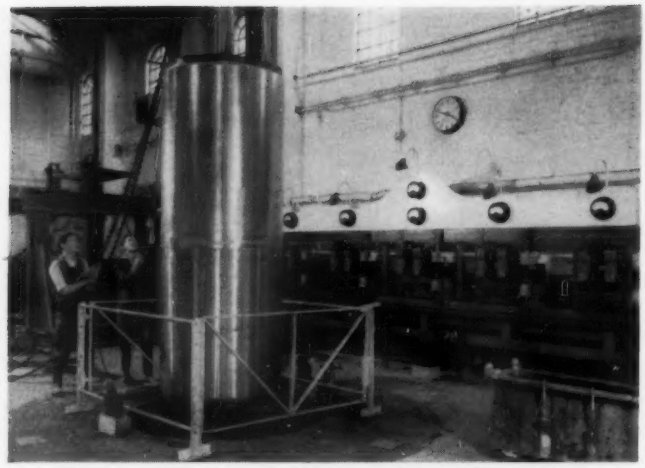
Automatic plant for continuous zinc plating of strip (Riedel & Co.).



Part of a fully automatic installation at the Simca Auto Works in Nanterre, France. (Deinert & Co., Leonberg, Wurthenberg, Germany.)



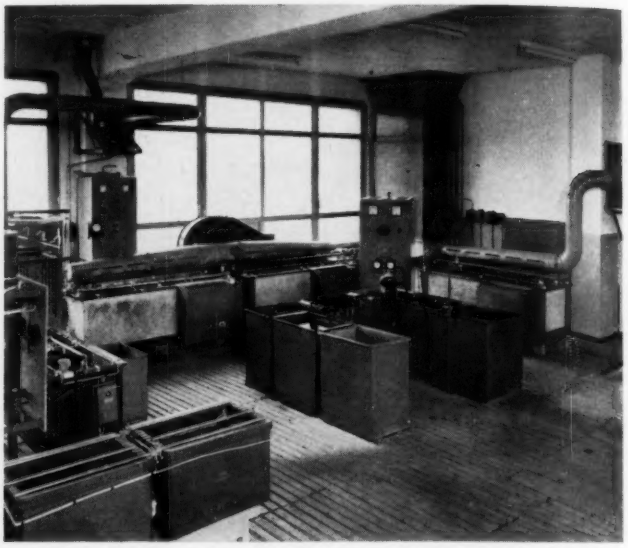
Fully automatic plant for motor car parts at the Volksvagenverk in Wolfsburg, Germany (Deinert & Co.).



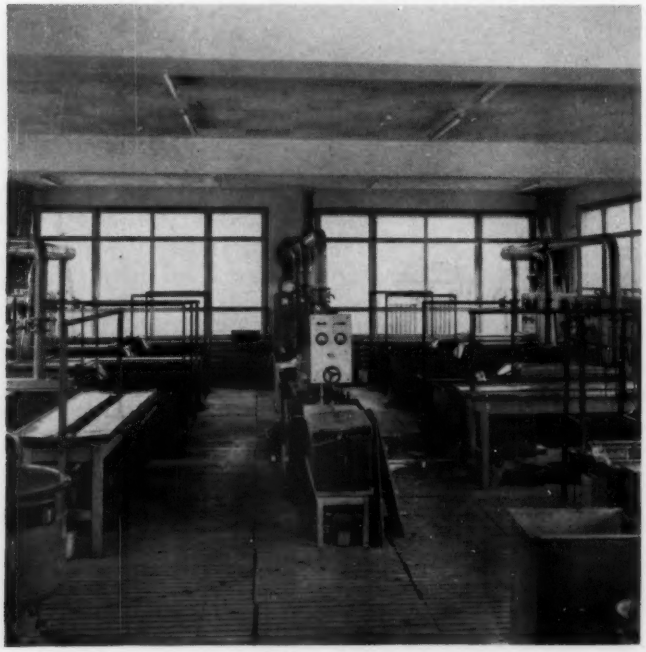
Hard chrome plating of a large cylinder at the Ionic Plating Company in Birmingham, England. Ionic does extremely varied job plating work in a modern shop. (Alkan, Ltd.)

A section of the large Pyrene Co. plating shop in London. This section plates automobile bumpers (Alkan, Ltd.).

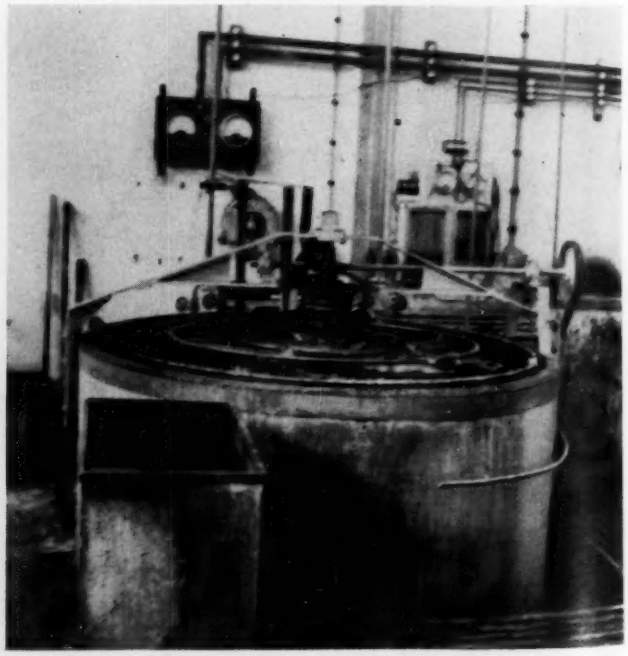
A part of the Rugby works of the British Thompson Houston Company in England. Electrical components are plated here (Alkan, Ltd.).



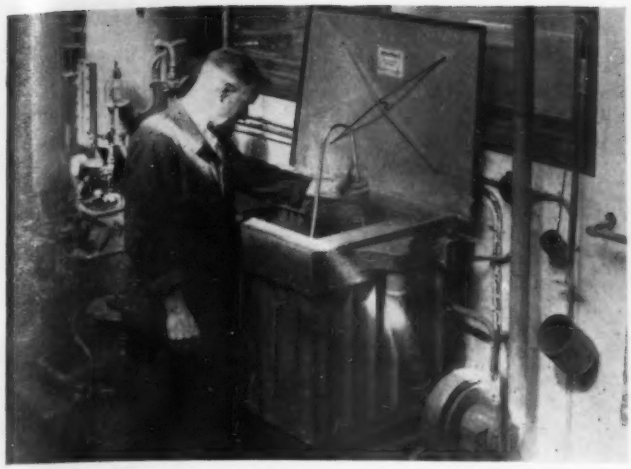
A section of the Fresard watch case factory in Bassencourt, Switzerland installed by Reymond & Co.



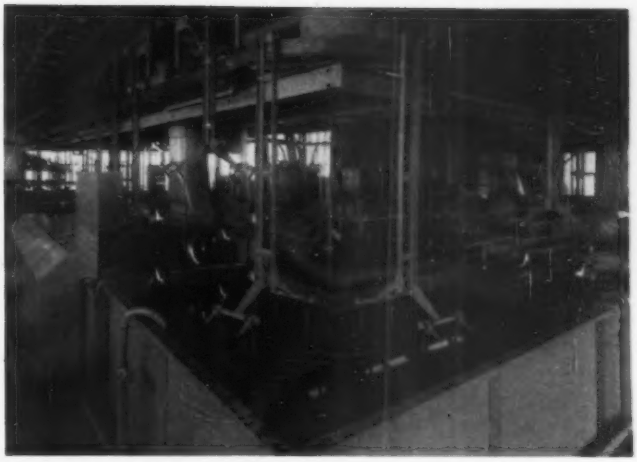
Another view of the racking tables and drying section of Fresard used in plating watch cases. (A. Reymond & Co.)



A circular type automatic bath in operation at the Simplex Bicycle Company in the Netherlands. (Plating Chemie.)

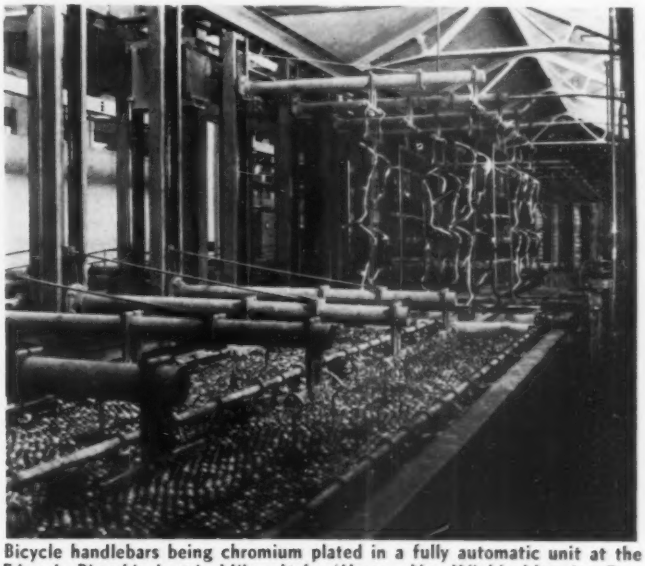


A degreasing operation in the job plating shop of the Stokkemans Brothers in the Netherlands (Danpoort).

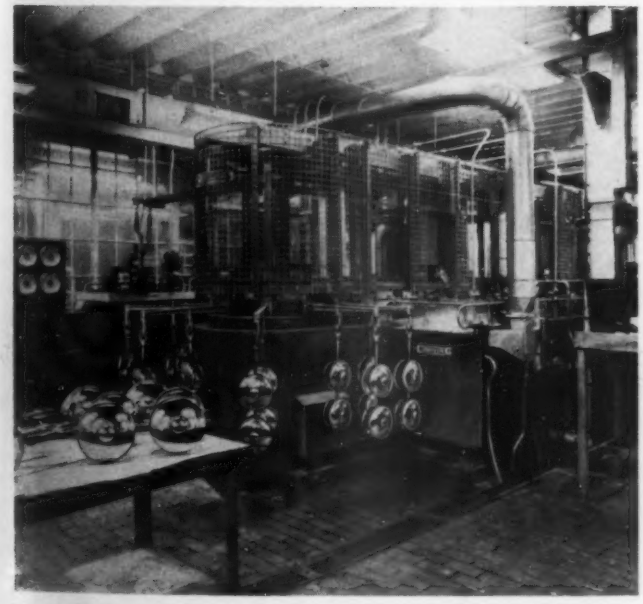


A ten thousand gallon fully automatic nickel plating installation at Projecteurs Marchal located at Pantin (Seine), France. This plant manufactures automobile headlights (Andre Waldberg).

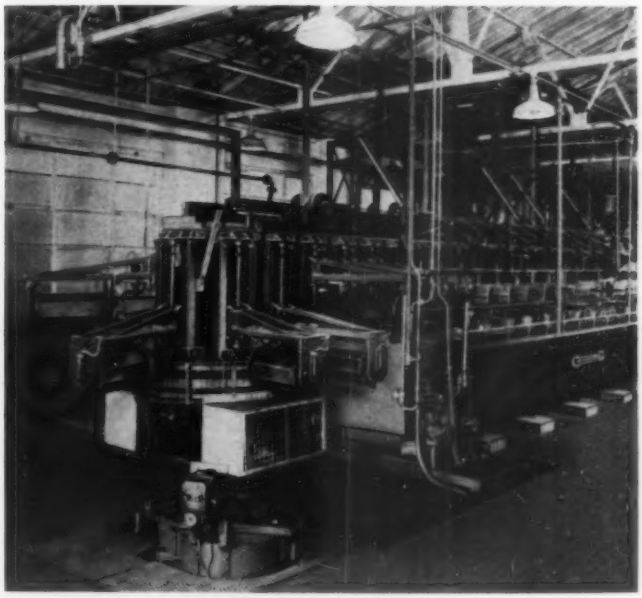
A semi-automatic bright nickel and chromium plating installation at the National Radiator Company, Clichy, France. (Andre Waldberg.)



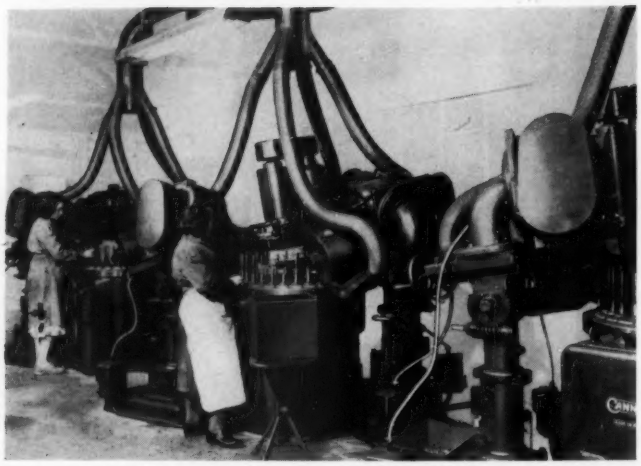
Bicycle handlebars being chromium plated in a fully automatic unit at the Eduardo Bianchi plant in Milan, Italy. (Hanson-Van Winkle-Munning Foreign affiliates.)



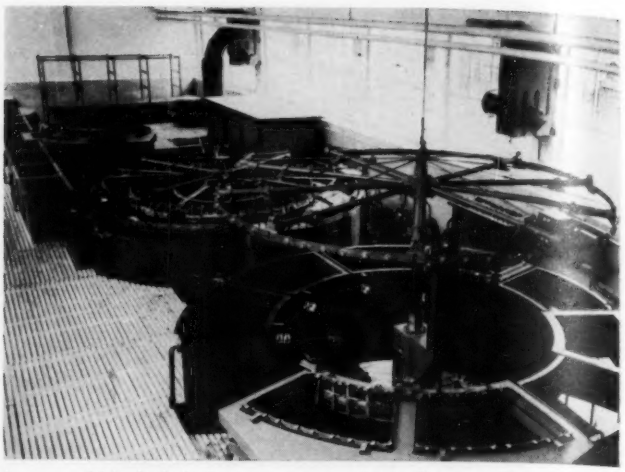
Automatic return type copper, bright nickel and chrome plating plant, installed by Canning & Co., Ltd., for automobile knave plates. (Ford Motor Co., Ltd.)



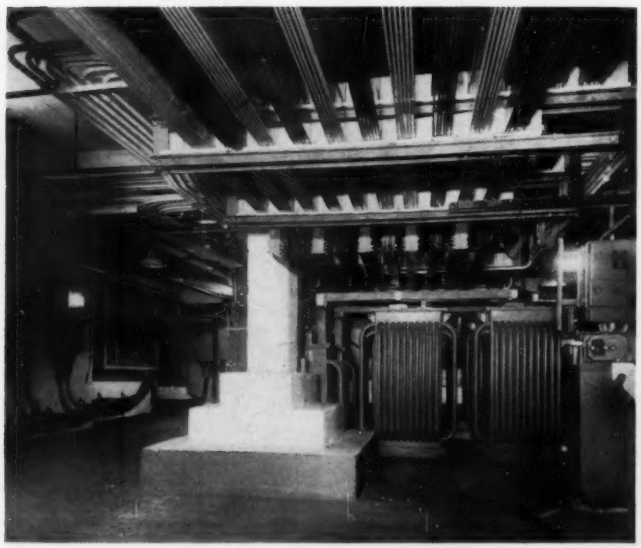
Automatic barrel installation for zinc plating screws, installed by Canning & Co., Ltd. (British Screw Co., Ltd.)



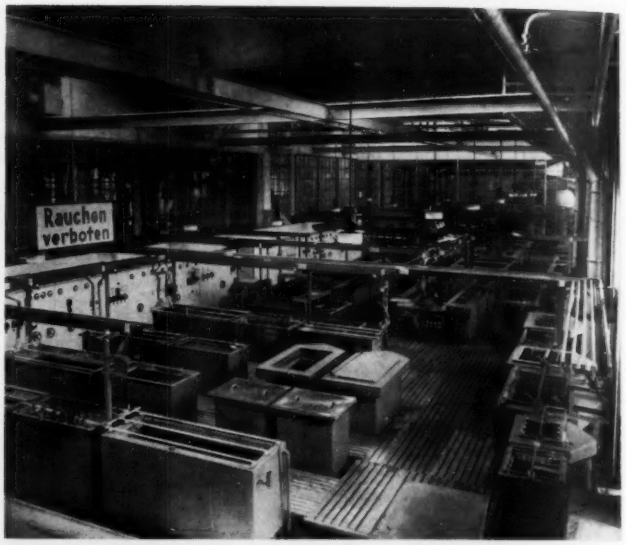
Part of a battery of automatic polishing machines at Scrib Anodizing Ltd., England for processing ball point pen caps. (Canning, Ltd.)



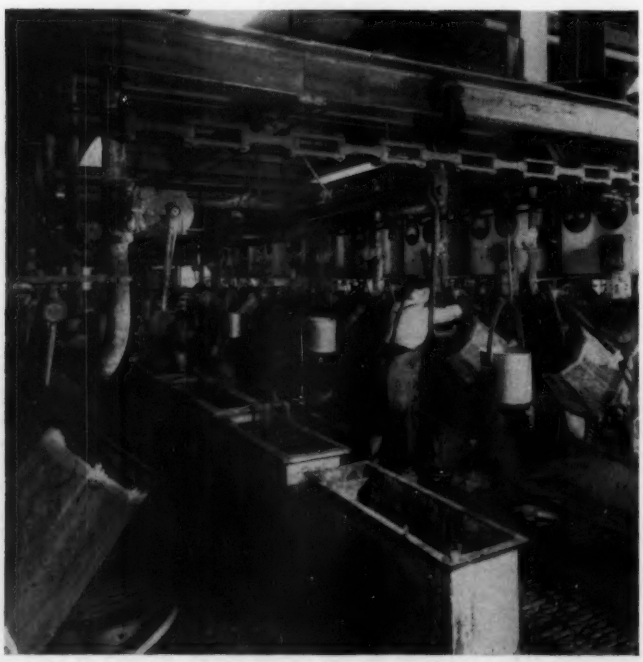
A group of 'ringbader' of a type very popular in Germany. The one in front is known as the 'merry-go-round.' (Blasberg.)



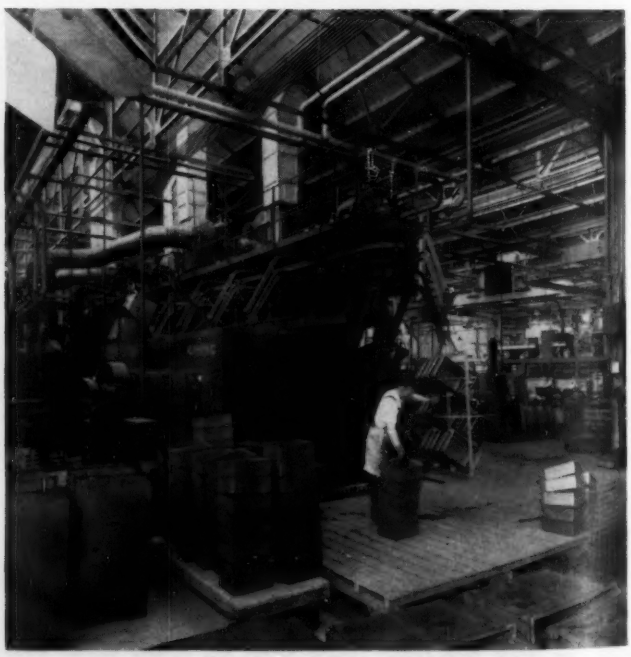
A separate room containing a battery of rectifiers serving the bumper plating section of the Pyrene Co. in London. (Alkan, Ltd.)



A general view of the plating shop of Messrs. BMW in Munich, Germany. Parts for automobiles and motorcycles are finished here. (F. Blasberg.)



A view of the barrel plating section of the large and diversified Ionic Plating job shop in Birmingham, England. (Alkan, Ltd.)



Automatic cleaning and pickling plant for refrigerator components at Frigidaire, Ltd. of London, England. (Canning, Ltd.)

Commercial Aspects of European Finishing

By Joan Wiarda and Marvin Rubinstein

IT is difficult for the average American who has never had any commercial experience abroad to understand some of the severe difficulties which have held back the development of a modern, up-to-date metal finishing industry in Belgium, Great Britain, France, Western Germany, Italy, the Netherlands and Switzerland.

Most readers will realize that the heavy toll of two world wars — particularly World War II — has not only resulted in virtually destroying many firms but has also played havoc with the economy of these countries. Until you have seen some of the destruction with your own eyes, however, it is difficult to get a true picture of the courage required to rebuild war torn industries in the manner that the firm in the accompanying photographs has done. And this is only one example of many.

Limited natural resources provides a second easily understood factor in explaining the backward condition of most of the finishing firms in these countries. We in the United States have always taken for granted the almost unlimited supply of almost all necessary raw materials within our own borders. This condition is not duplicated in Europe, where many and in some cases all raw materials, chemicals and supplies have to be imported and paid for in foreign currency.

"Limited Markets"

The foregoing reasons are concrete, but it is less easy to understand the psychological reluctance of many European finishers to purchase new equipment and processes for their plants and the equal reluctance of European bankers to provide the capital for this expansion and modernization. The answer can be found in the term "limited market."

A clearer picture of the limited market for manufactured goods in each of these countries can be obtained if we try to imagine that each of the 48 American states is an independent country. Each State has its own currency and this currency is different in value from each of its neighbors. The people in each State speak a different language and are vaguely distrustful of the residents of all the other States. Borders are rigidly patrolled and in order to import goods from another State, it is necessary to obtain complicated currency exchange permits and to pay a heavy duty. Consequently, exports to another State present similar difficulties. Now, the question is whether you, as a manufacturer in, say, the State of New Jersey would be willing to greatly expand your manufacturing facilities under these conditions. A little thought given to this question will clearly show the dilemna of the French or Italian Finishing plant owner.

For, the imaginary situation above is the real situation in the seven countries visited by the authors. In these seven countries, seven languages are spoken. In Belgium, some people speak only French and some only Flemish. In Switzerland, large sectors of the population speak largely French or German or Austrian or Italian. They all use different monies, and it is difficult to obtain Government permission to exchange local currencies for the currency of another country so that you might buy something there. To obtain U. S. dollars is the worst task of all. Furthermore, customs and taxes on imported goods are appreciable. What all this means is that the citizens of each of the seven countries visited find it difficult to buy from or sell to the people of the other six.

The result is that the manufacturer's market is immediately limited largely to the people of his own country. This is an important limitation, since these countries are small as compared to the U. S. Three of them have populations lower than the State of Pennsylvania. The populations in each of the other four countries is from ¼ to ⅓ of the U. S. population. But, even within each country, the market is limited, for the standard of living in all seven is very low by U. S. standards.

A plater's helper in France, for example, gets about the equivalent of 45 cents an hour. A skilled plater in England gets about $1.15 an hour. It is true that the cost of living, i.e. for food and housing, is cheaper there, but the cost of manufactured products is not appreciably so. With salaries at this level, it is inevitable that the standard of living be low. Only a small, "limited" percentage of the population is able to buy the many items we in the U. S. take for granted — automobiles, refrigerators, electric mixers, etc. And these are usually the type of items which require metal finishing; most basic necessities don't.

The net result is that the very "limited market" in each country can usually be supplied by the outdated methods now being used. The authors were often asked, "Why put out a better product when few will pay the increased price?" and "Why put out a larger production when there are only a limited number of people who can afford to buy our product anyway?" So speak the platers, and the bankers who provide the funds for expansion are in more than complete agreement.

Some Progress Made

In spite of this tremendous fear of overproduction, considerable progress has been made in certain areas, as can be seen in the article on technical development. Much of this progress has been during the last six or seven years. Some of it has been sparked by U. S. suppliers who, despite difficulties, have found ways of entering the European market with modern products such as bright nickels.

Many suppliers reading this article will wonder just how this has been done, since attempts at direct sales or at finding European distributors have been dismal failures. The dollars were just not available at the other end, and with high American labor costs, the prices of U. S. equipment and processes were much too high for the average European finishing plant. One solution to this problem has been in sublicensing the U. S. process or equipment design to suppliers in one or more of these countries. Using cheap local labor, the European supplier has managed to make and sell the U. S. design or formulation at a price within the reach of local finishing plants. The net result has been progress in European finishing and royalties in the pockets of foreward looking U. S. suppliers.

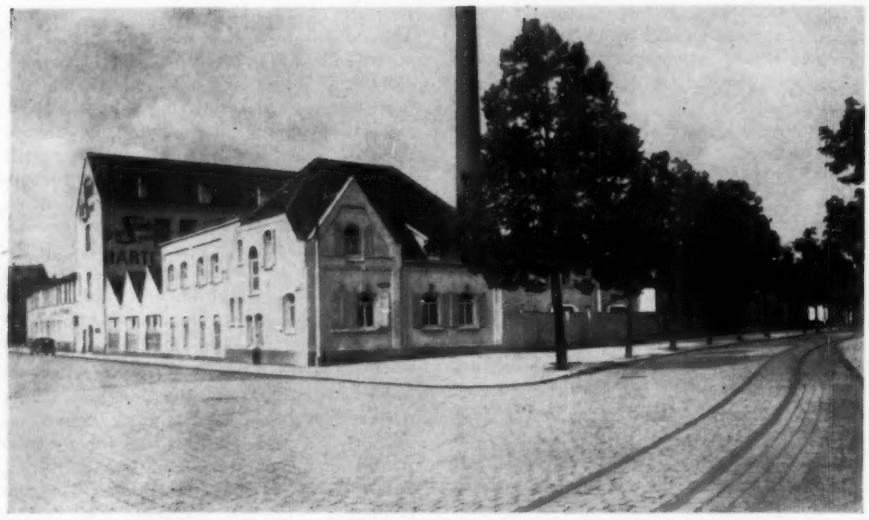
This is not to say that these licensing agreements have not had their difficulties and problems. The authors heard many complaints about red tape and late deliveries, particularly on reorders. Another common complaint was that European distributors for licensed U. S. processes have given preference to firms in their own respective countries and discriminated against shops in neighboring lands. This could, of course, be cured by sublicensing one firm in each country, which should be the ultimate aim. Undoubtedly, the U. S. parent firms have their complaints as well. However, it is felt that these difficulties will work themselves out in time, for the general idea is good.

On the black side of the picture, very little has been done to bring European advances (in certain special areas) over to the United States for the use of finishing firms here.

Some Suggestions and Conclusions

What are the answers to the difficulties holding back European finishing? On the economic front, it is difficult to say, since the problems are very complex and the authors are not economists. Some easing of trade restrictions would seem in order, as would also be a drive toward the free convertability of at least the most important European currencies. If a manufacturer

An up-to-date barrel plating installation for zinc, cadmium and tin at the Telemecanique Company in Mainterre, France. Installed by Andre Waldberg and Co.



The firm of Gebruder Schoch (Schoch Brothers) in Stuttgart-Feuerbach, Germany before World War II. This is the largest job shop in Germany and probably in Europe.

The same firm, Gebruder Schoch, completely destroyed by bombing during the war.

A new and rebuilt Gebruder Schoch now boasts a fleet of several hundred trucks which pick up job plating all over Western Germany — a miraculous feat of recovery.

could feel that his potential market were the 214 million people in all the seven countries combined, his first move would be towards automatic equipment and modern processes.

The authors did agree, however, that notwithstanding the low income level of the average European worker, not enough was being done to stimulate in him the desire to own a variety of manufactured goods. It is felt that the pursuance of a more dynamic advertising and sales policy by manufacturers in Europe would result in an enlarged market for their products. Advertising produces demand. Demand produces greater supply. And greater supply eventually means more wages, better living and more demand.

These are rather elusive questions. However, to the American finishing supplier with a new process to sell, more concrete suggestions can be given. It is strongly felt that there is a ferment in the finishing industries in the seven countries covered by this article, and the time to get your product on the European market is *Now*.

Several arrangements for marketing U. S. products abroad are possible. Direct distributorships are possible, but have not worked out well. A sublicensing arrangement on a royalty basis of the type previously described seems to be a successful arrangement. Another possibility with certain advanced European suppliers is a quid-pro-quo licensing arrangement where they acquire the right to manufacture and sell the U. S. process in return for the right to manufacture and sell the European firm's process here. Some smaller firms have worked out sales percentage arrangements where no currencies are transferred from Europe to the U. S., but funds are made available for business (or pleasure) trips whenever the firms owners are abroad in the countries where their processes are being sold. In matters such as these, where there is a will, there is a way.

Lists of principal European metal finishing suppliers are available on request from METAL FINISHING.

The authors wish to extend their thanks for the courtesy and cooperation shown them all during their trip abroad by everyone in Europe's metal finishing industries. They particularly appreciate the time and attention given them by the following supply houses:

M. L. Alkan, Ltd., W. Canning & Co., Ltd., Electro Chemical Engineering Co., Ltd., Johnson Matthey and Co., Ltd. and Silvercrown, Ltd., all of England; Friedr. Blasberg Co., Dr. W. Kampschulte & Co., and the Langbein-Pfanhauser Works, all in Germany; A. Reymond & Co. of Switzerland; the firms of Danpoort N. V. and Plating-Chemie N. V. in the Netherlands; Dr. Barratini and Sons in Italy; and A. Waldberg S. A. in France.

Also of tremendous assistance were the following engineers and consultants in the field:

Dr. Cuthbertson (Tin Research Institute), Mr. C. R. Draper (Electroplating), Mr. E. A. Ollard (Non-Ferrous Metals Research Council), and Dr. A. Stiers, all of England; and also Dr. R. Springer and Mr. H. Benninghoff, both of Germany.

The Structure of Electrodeposits

By J. J. Dale

Part I of this article appeared in our July issue. This is the second, and concluding, installment.

Effect of Basis Metal

The above considerations hold for the majority of cases where growth is influenced more by plating conditions than by the basis metal. However under certain conditions the basis metal exerts a profound effect on the deposit, and we then get the phenomenon known as *continuity*.

Here the growing electrolytic crystals appear to be built on to individual basis metal crystals, showing the same habit and orientation, and having boundaries which appear as continuations of those of the basis metal crystals. This effect is illustrated in numerous published photomicrographs, of which Figures 18 and 19[13] are examples. The two upper layers visible in Figure 18 are coatings of copper and nickel deposited over the "continued" copper layer for protection of the edge in polishing. Figure 19 is a view at a higher magnification of the crystal marked with an arrow in Figure 18. The etching pits show the orientation to be the same in the basis metal and deposit crystals. Continuity occurs on a large scale only in special cases and all published examples are from specially prepared specimens.

The three micrographs shown in Fig. 20 show how the effect is governed by treatment of the basis metal. To get good continuity it is usually necessary to etch

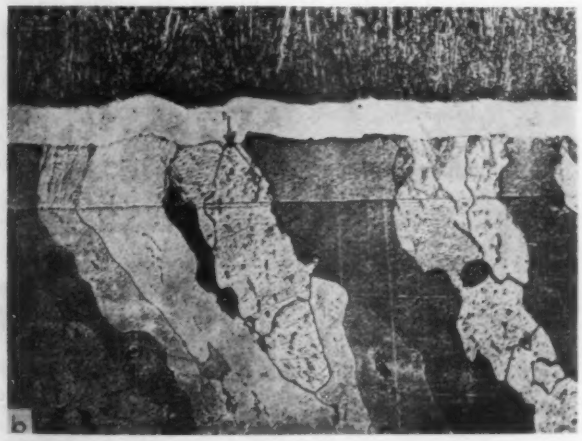


Figure 18. Copper Deposited on Cast Copper [13] Showing continuity X100.

Figure 19. Copper Deposited on Cast Copper [13] Etching pits show continuation of crystal structure X500.

deeply to make sure of removing the altered layer which is present on a polished or machined surface.

The most outstanding work in this field was done by Hothersall[14] who showed the effect for a number of metal combinations. He found that continuity between metals which have the same crystal system was possible only when the ratio between their lattice parameters was within certain limits, and he put forward the theory that some degree of continuity probably occurs in many cases where a high degree of adhesion is obtained between basis metal and deposit.

This theory has since been confirmed by X-ray and electron diffraction which have shown that some degree of continuity occurs in most cases of electrodeposition although it rarely persists for a sufficient thickness to be microscopically visible.[15] The actual thickness of the "base oriented" layer varies widely in different

cases, depending mainly on the magnitude of the "self orienting" effect of the metal being deposited.

Adhesion between deposit and basis metal frequently exceeds the strength of the weaker metal of the two. It is now generally agreed that when this degree of adhesion exists, the deposited metal conforms for one or more atomic layers to the lattice system of the basis metal, and actually builds on to the lattice so that the adhesion is due to atomic bonding of the type existing in the body of a solid metal.

A relatively fine grained zone next to the interface, similar to the chill crystal zone in a chill cast structure, is frequently visible in microsections and can be seen in Figures 4, 5 and 8. This has been attributed by some to the influence of the disturbed or flowed surface layer of an industrially prepared article. The appearance may, however, be contributed to by differential etching between deposit and basis metal.

The presence of a fine grained zone next the interface is reflected in changes in properties of deposits with increase in thickness. In the author's laboratory the following micro-hardness (Knoop) readings were obtained on opposite sides of a separated Watts nickel deposit 0.009" thick.

At interface	250
Away from interface	180

Substantial reductions in hardness and tensile strength of similar deposits with increase in thickness are reported in A.E.S. Research Report Serial No. 20, covering work at NBS on A.E.S. Research Project No. 9. (This report also includes a full survey of microstructures of nickel deposits produced over a wide range of conditions.)

Effects of Inclusions and Other Foreign Matter

Purity of Deposits. Electrodeposits are never absolutely pure and deposits from commercial baths contain easily detectable quantities of foreign matter, both metallic and non-metallic. Impurities come from a number of sources, chiefly from anodes and salts dissolved to make up the solution, but also from dust and dirt entering the bath from the air or carried in on objects to be plated, anodes, anode bags, etc. A very important type of impurity can arise even from a pure bath. This type includes hydroxides and other basic compounds formed by precipitation in the electrolyte adjacent to the cathode where the acidity may be reduced by hydrogen discharge. This hydrogen itself is not always evolved, but frequently enters the deposit as an impurity. Schlotter[16] quotes the following measured hydrogen contents of electrodeposits:

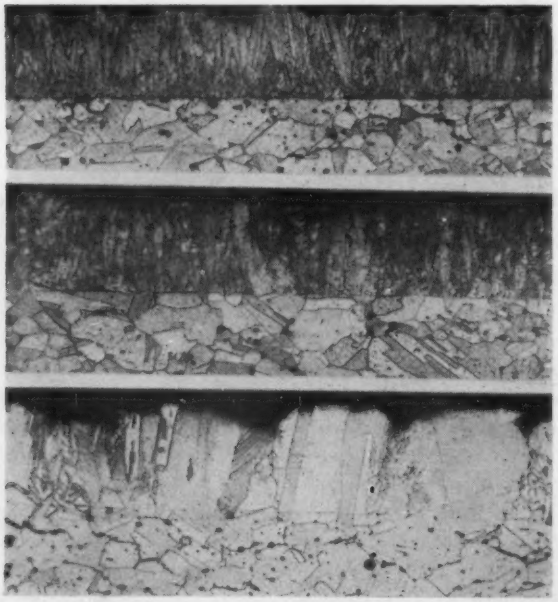


Figure 20. Micro-structure of Copper Deposit on Polished Copper cleaned for deposition (a) Without etching X100. (b) By light echting. (c) By deep etching.

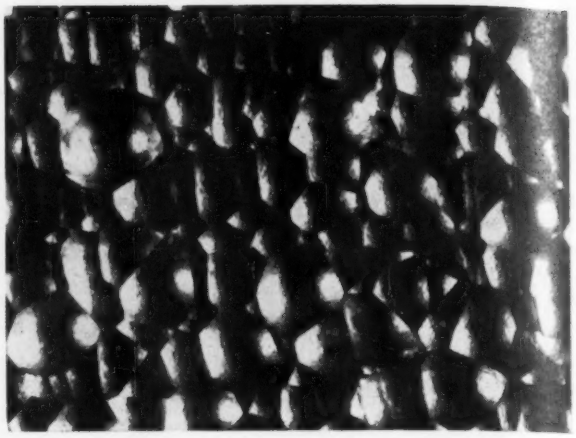


Figure 21. Nodular Sruface of Chromium Deposit X30.

Metal	*Volume % Hydrogen*
Nickel	660
Tin	12
Iron	6000
Zinc	2000
Chromium	260,000

To illustrate the "carry over" of impurities from anode to cathode, the following analyses also quoted by Schlotter are included. The metal being plated was iron.

	C %	P %	Si %	S %	Mn %	Fe %
Anode, of Swedish ore	0.026	0.007	0.109	0.007	0.021	99.595
Cathode, after a single refining	0.019	0.013	0.002	0.006	Nil	99.960

A further important type of foreign matter in deposits comes from the addition agents, mostly organic or metallic, which are introduced in relatively small amounts to smoothen or brighten the deposit surface. The effects of very small amounts of addition agents can be considerable. One part in a million of peptone added to an acid copper solution causes appreciable grain refinement while the same proportion of lead or silver in a cyanide copper bath produces notable structural changes.[1]

Inclusions. Impurities in deposits may be present either in solid solution in the metal, or as discrete foreign particles which are known as inclusions. These latter may be regularly dispersed or positioned at random and may vary in size over a wide range. In whatever way they occur, they can play a big part in determining structure. Most nickel deposits, on annealing, show foreign matter in the grain boundaries, be-

lieved to be nickel oxide.[17] This material is invisible in the microstructure of the deposit, and is considered to have been included in the deposit during deposition as very fine particles of hydroxide, which had been precipitated as a positively charged colloid in the film of liquid next to the cathode.[18] These are attracted to the cathode where, by interfering with crystal growth, they cause refinement of grain size and are included. Further, by interfering with normal slip processes of deformation they could well provide the answer to the abnormal increase in hardness observed when a finer grained deposit is produced. Partial confirmation of this theory is given by the observation that agents which flocculate the colloidal hydroxide give softer deposits.[18]

(Hothersall[2] has given a useful summary of present knowledge and theories on colloids and their effects in electrodepositing.)

A parallel case occurs with deposited chromium, which, in addition to regularly spaced visible inclusions, is believed to contain extremely fine inclusions which, through slip interference, may contribute to its extraordinary hardness.[19]

Large inclusions occurring at random can cause local inhomogeneities in the deposit structure. Different occurrences of this nature have been described and illustrated at some length by Cymboliste.[20] Figures 8 and 13 show growth of nodular and fan-like structures from inclusions.

Bright Deposits

The production directly from the plating bath of bright deposits which need no further mechanical finishing is attracting very wide commercial interest at the present time. Bright deposits as a class are characterized by extremely fine grain size, and also by the fact that their production is obtained only through the use of addition agents, an organic compound being nearly always involved. As the volume of bright nickel plating being done far exceeds that of any other metal, most of the investigational work on the subject has been done with nickel. Accordingly, since it is fairly typical, this metal alone will be dealt with here. Early theories for brightening action were based on the very fine grain size of the deposits and on the possibility of preferred orientation, causing certain crystal faces

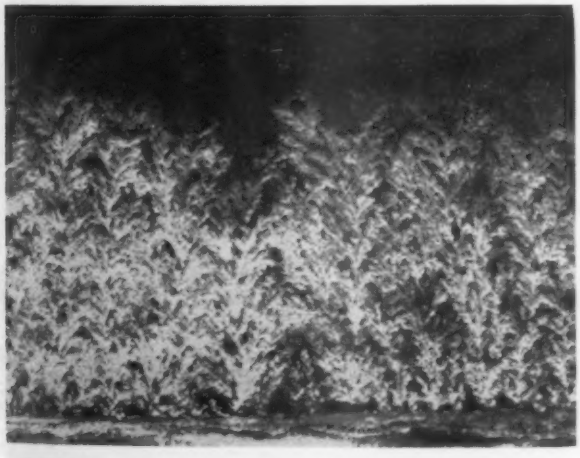


Figure 22. Treed Copper Deposit from Cyanide Bath X10.

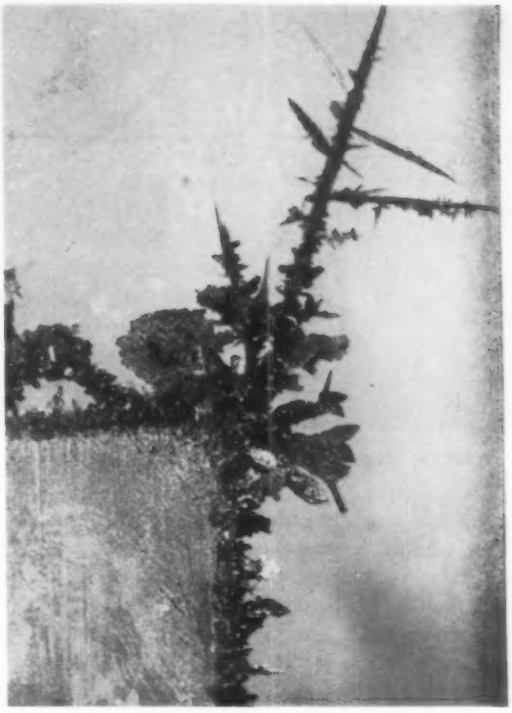


Figure 23. Treed Lead Deposit X1.

to be laid out more or less flat on the surface so as to give a reflecting surface[1]. Observations on the degree of preferred orientation on bright nickel deposits from different baths[21,22,23], however, showed no consistency and it is evident that some other factor must be operating.

The most recent explanation has been put forward by Gardam,[24] who has shown microscopically and chemically that sulphonates (the major class of organic addition agent in use), can be included in the deposit. Analyses of bright nickel deposits give up to 0.4 per cent. carbon and 0.2 per cent. sulphur. When the metal is dissolved chemically, a waxy residue remains. A further pertinent fact is that most bright deposits, when examined microscopically, show a laminated or banded structure. Gardam supposes that a film of sulphonate is adsorbed on the cathode surface and that this film is thicker on the high spots and projections than in the recesses or low spots and accordingly, current is diverted from the high spots to the low spots which receive extra deposit until a perfectly level surface is developed. The current diversions are periodic and cause variations in the nature of the deposit which give rise to laminations in the microstructure. In cases of laminated deposits, periodicity may under favorable circumstances be observed in measuring electrical quantities, current and potential.

In support of this theory Gardam[25] has shown that practically all bright nickel plating baths have a strong "smoothing action," that is, the surface of the deposit is smoother than the basis metal surface.

Alloy Plating

Deposition of alloys is now so well established and has been extended to so many metal combinations that it would almost be simpler to list alloys which have not been plated, rather than those which have.

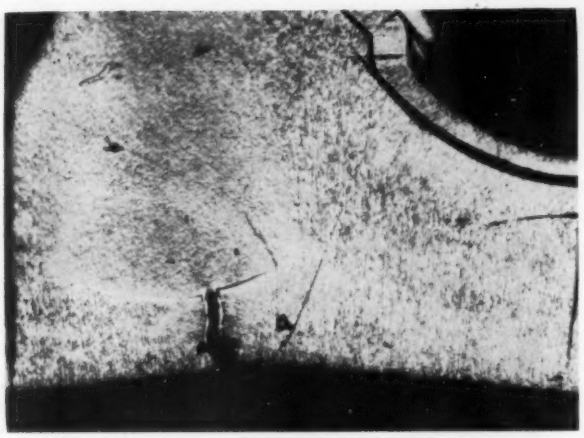


Figure 24. Nickel Deposit Showing Stress Cracks X100.

(Raub[26] has recently published a useful review on this subject.) Simultaneous deposition of two metals is possible whenever their ionic concentrations can be so adjusted that their deposition potentials are the same. Use of compounds like cyanide, which form complex ions, makes this possible in a large number of cases. Another characteristic of alloy baths is their need of organic addition agents. The structure of alloy deposits is characterized by extremely fine grain size. Where a duplex alloy is to be expected from phase diagram considerations, the two phases are usually present, but the grains are normally too fine for them to be observed microscopically. The phases are, however, detectable by X-ray diffraction. Occasionally the phases are deposited alternately and a banded deposit is obtained. Figure 12 illustrates this for a lead-copper alloy, in the plating of which electrical periodicity was recorded.[5]

Considerable X-ray diffraction work has been done on brass deposits of different compositions and all of the phases occurring in thermal alloys have been detected in deposited alloys. The phase boundaries, however, do not always agree, and the discrepancies, which may be of the order of 4 per cent for a certain phase, make it appear that the deposited metal is in a form unstable at room temperatures. One investigation[27] in particular showed beta brass to be present in the disordered form, which is the stable form at higher temperatures. There was, however, considerable disagreement in the results of the two chief investigations[27, 28] in this field and further work is required to determine the true position.

A very interesting case of alloy deposition is the preparation of tungsten alloys with iron, cobalt and nickel.[29] These alloys, like their thermal counterparts, are age-hardening, but the interesting point is that the deposited forms do not require a solution treatment as the minor constituent is already in solution. This is another case of the deposited alloy being in a "high temperature" or metastable form. The literature contains several similar cases. Thus a 2.6 per cent copper-tin alloy has been plated as a solid solution, whereas it should be duplex, and a metastable 5.2 per cent tin-lead solid solution has also been deposited.[30] This phenomenon is not confined to alloys but occurs also with allotropes of pure metals. The metastable gamma manganese can be deposited under certain conditions instead of the stable alpha form.[28] No serious attempt seems to have been made yet to explain these occurrences.

On the subject of allotropes, two further cases are worthy of mention. Cobalt can be deposited in two forms, and chromium has been understood for many years to possess a hexagonal modification in addition to the normal body-centered cubic form. Recently, however, it has been suggested that the hexagonal modification is really a hydride.[31] In addition, a further type of lattice, face-centered cubic, has been produced under certain plating conditions. This is believed also to be a hydride. Both these types revert on heating to the body-centered cubic form. Experiments in the author's laboratory have shown the face-centered cubic lattice to be more stable than previously believed. The matter requires further clarification.

Abnormalities and Defects

NODULES. Nodules and nodular formations are fairly frequently seen, particularly on thick deposits. They may occur at random or may be evenly distributed, as in Figure 21, which shows the surface of a thick deposit of chromium. The regularity of these nodules is typical of chromium. It is also possible to get, on an otherwise smooth thick chromium deposit, randomly-situated nodules of such a type that they are torn out on grinding, leaving a cavity or pit in the deposit.

Factors increasing the size and occurrence of nodules are:

1. Increased thickness of deposit (or plating time).
2. Suspended particles in the bath and foreign matter on the cathode surface.
3. Increased current density.

Nodules are often found on the edges and corners of thickly plated rectangular sheets, at which locations the local current density is high.

A very recent paper by Swanson[32] describes a rather ingenious piece of research including microscopic examination of nodules in nickel deposits, produced intentionally by addition of various foreign particles which acted as nuclei. Materials added included graphite, metallic nickel particles, and green and black nickel oxides. Nodule formation in production baths

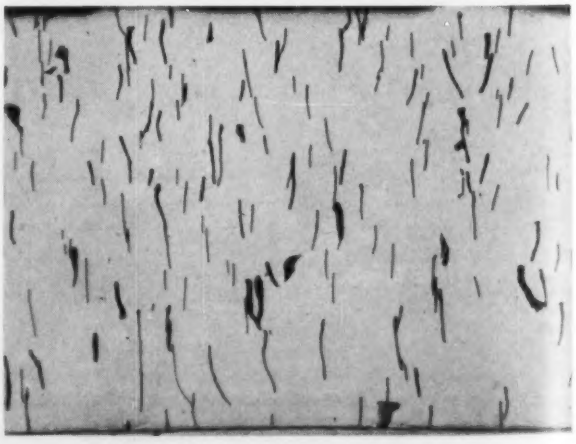


Figure 25. Chromium Deposit X200.

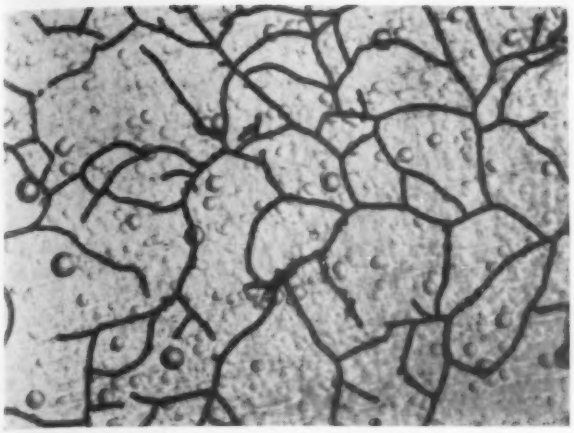


Figure 26. Copper Plated Surface of Chromium Deposit X100.

was traced to certain materials. These included steel slivers and copper particles from roughly polished surfaces, and metallic nickel and nickel oxide particles resulting from faulty anode corrosion.

TREES. There are two main types of trees, the difference between them being due to the type of bath. Figure 22, showing copper deposited from an unbalanced cyanide copper bath, illustrates the commonest form of treeing which can be considered as built up by continued growth of small nodules one upon the other. The grain size here is extremely small, each nodule consisting of a very large number of crystals. The other type of treeing met with is illustrated in Figure 23. Here the trunk and each branch of the tree are single crystals. This type of treeing is typical of lead and silver deposits from certain types of solutions.

PITS. Pitting in electrodeposits is unfortunately an all too frequent occurrence owing to the practical difficulty of removing the chief causes of pits which are

1. Presence of suspended matter in the bath.
2. Contamination on the surface of the article to be plated. The contamination may be from an external cause or can be internal in origin as, for example, non-metallic inclusions in steel.

Practically all commercially-troublesome pitting occurs in nickel deposits. It is usually ascribed to the action of a bubble of hydrogen, formed in the bath, adhering to the cathode surface and preventing deposition at the point of adhesion by denying access to the solution. Points at which hydrogen bubbles adhere are usually points where contamination is present. Cymboliste[33] has dealt exhaustively with different types of pitting and the formation and behavior of hydrogen bubbles in plating solutions.

BLISTERS. A blister is formed where a small area of a deposit is lifted from the base metal without being separated from the rest of the coating. It nearly always occurs over an area where adhesion is poor or nonexistent. From such areas the deposit may be lifted either by its own internal stress (as in the case of cadmium), or by release of gas from within the basis metal. Steel, for example, frequently absorbs large quantities of hydrogen during acid pickling, release of which may cause blistering where adhesion is poor. Steer[6] describes another type of blister caused by ingress of corrosive medium through a pore in the deposit.

CRACKS. Occurrence of cracking is confined to brittle deposits which are highly stressed. Stresses in deposits are revealed by X-ray diffraction and can also be measured by deflection of thin strips plated on one side only with the metal in question. Figure 24 shows stress cracks in a brittle nickel deposit. Stress cracking is uniformly distributed in thick bright chromium deposits and occurs according to a definite pattern which defines the chief feature of the structure of this metal. It is supposed that cracks are formed uniformly as successive layers of chromium are deposited, and that these cracks fill with basic material during plating to give the inclusions which characterize the microstructure.[19] Figure 25 shows a typical microstructure, while Figure 26 shows the pattern obtained when a chromium deposit is copper plated to reveal cracks penetrating to the underlying steel base.

BURNT AND POWDERY DEPOSITS. Burning of a deposit is one of the effects of excessive current density. The surface is rough and dark in appearance, and in certain cases contains more than the normal amount of oxide. Burnt deposits are frequently friable and weak, and lack lateral cohesion. A powdery deposit is a special case of a burnt deposit, and is obtained mainly from certain types of plating solution. It can be likened to a modified form of treeing, in which the branches of the trees are very weakly held together and fall apart readily.

Effects of Structure on Properties and Uses of Electrodeposits

It will be obvious that many of the features described in the foregoing part of the paper, particularly the defects, will have a profound bearing on the properties and uses of metals in the electrodeposited form. Care must be taken, for example, in using brittle deposits in mechanical applications. Cracked, pitted and blistered deposits will be unsuitable for corrosion protection.

Effects of certain other features, however, are not so obvious. The generally finer grain size of electrodeposits and the presence of inclusions results in electrodeposits being harder and less ductile than the same metal in the cast or annealed forms. Most metals can be plated under selected conditions to a greater hardness than when fully cold worked. For the commoner

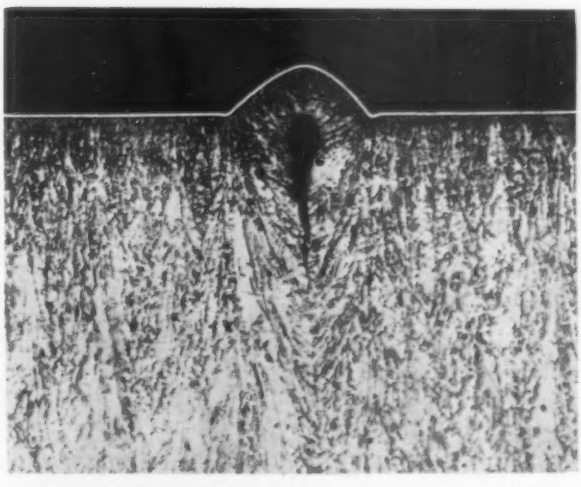


Figure 27. Defect in Electroformed Record Stamper X100.

metals, the variables have been worked out so that the metal can be plated almost at will to a given hardness figure over quite a wide range[7,11]. The relatively large changes in grain size which occur with change in plating conditions have been found to accompany even more striking changes in mechanical properties. Hardness increases from 120 to 220 D.P.N. have been recorded in nickel deposits when bath temperature was lowered from 80° to 30°C.[11]

Copper deposits shown in Figures 4 and 17 had hardness values of 65 and 110 D.P.N. respectively. An increase in the temperature of an acid copper plating bath from 25° to 40°C. is reported to have reduced the tensile strength of the deposit from 18 to 9 tons per square inch.[9]

The laminations in laminated deposits are often found to be planes of weakness which initiate failure when deposited metals are tested to destruction. The same applies to planes perpendicular to the cathode surface, which are formed by the junction of two crystal systems and which may contain included non-metallic matter or even voids. An example of the latter is shown in Fig. 27 which is a section of an electroformed record stamper. The edges of the large needle groove have initiated fast growing crystals which have bridged over and prevented the joining up of slow growing crystals from the walls of the groove. This defect resulted in fracture of the stamper in service.

Conclusion

The above review is an attempt to summarize in a reasonably simple form the present state of knowledge of the structure of electrodeposits. A great deal of work has been done, far more, in fact, than could be dealt with here. As will be judged, however, from the tentative tone of much of the review, a great deal still remains to be done, not only in discovery of new pertinent facts and in the extension of systematic surveys, but also in integrating the mass of available data into an easily grasped picture.

Obvious topics for future research include:

1. Investigation of the causes of the abnormal hardness of many deposits, and the abnormal changes in hardness noted with change in plating conditions.
2. Study of the mechanisms of introduction of foreign matter in deposits and of the forms in which it occurs in deposits.
3. Plating on different faces of large single crystals.[34] Different local current densities on different faces have been reported.[35]
4. Further research on the plating of metastable forms of metals.

References

1. Blum, W., and others, Trans. Electrochem. Soc., 80, 249 (1941).
2. Hothersall, A. W. J. Electrodep. Tech. Soc., **25**, 203 (1950).
3. Finch, G. I. and Layton, D. N. J. Electrodep. Tech. Soc., **27**, 215 (1951).
4. Portevin, A. M., and Cymboliste, M. Trans. Faraday Soc., **31**, 1211 (1935).
5. Phillips, A., and Meyer, W. R. Trans. Electrochem. Soc., **73**, 377 (1938).
6. Steer, A. T. Proc. Third Internat. Electrodep. Conf., 165 (1947).
7. Butts, A., and De Nora, V. Trans. Electrochem. Soc., **79**, 163 (1941).
8. Wilman, H. Discussions Faraday Soc., **1**, 193 (1947).
9. Blum, W., and Hogaboom, G. B. "Principles of Electroplating and Electroforming," 2nd ed. N. Y. McGraw-Hill, (1939).
10. Macnaughton, D. J. and Hothersall, A. W. Trans. Faraday Soc., **24**, 387 (1928).
11. Roehl, E. J. Am. Electroplaters' Soc. Monthly Review, **34**, No. 10, 1129 (1947).
12. Gardam, G. E. Discussions Faraday Soc., **1**, 182 (1947).
13. Blum, W., and Rawdon, H. S. Trans. Electrochem. Soc., **44**, 305 (1923).
14. Hothersall, A. W. Trans. Faraday Soc., **31**, 1242 (1935).
15. Clark, G. L., and others. J. Appl. Physics, **15**, No. 2, 193 (1944).
16. Schlotter, M. Trans. Faraday Soc., **31**, 1177 (1935).
17. Gardam, G. E., and Macnaughton, D. J. Trans. Faraday Soc., **29**, 756 (1933).
18. Macnaughton, D. J., and others. ibid. pp. 729-55.
19. Dale, J. J. Third Internat. Electrodep. Conf., 185 (1947).
20. Cymboliste, M. J. Electrodep. Tech. Soc., **13**, (1937), 14 pp.
21. Hothersall, A. W., and Gardam, G. E. J. Electrodep. Tech. Soc., **15**, 127 (1939).
22. Smith, W., and others. Plating, **36**, 355 (1949).
23. Clark, G. L. and Simonsen, S. H. J. Electrochem. Soc., **98**, 110 (1951).
24. Gardam, G. E. Third Internat. Electrodep. Conf. 203 (1947).
25. Gardam, G. E. J. Electrodep. Tech. Soc., **22**, 155 (1946-7).
26. Raub, E. Metalloberflache **7**, 17A (1953).
27. Raub, E. and Krause, D. Z. Electrochem. **50**, 91 (1944).
28. Banerjee, T., and Allmand, A. J. Trans. Faraday Soc., **44**, 819 (1948).
29. Brenner, A., and others. J. Research Nat. Bur. Standards, **39**, 351 (1947).
30. Voyda, T. Am. Electroplater's Soc., 33rd Annual Proceedings, 33 (1946).
31. Snavely, C. A. Trans. Electrochem. Soc., **92**, 537 (1947).
32. Swanson, C. J. Bulletin Inst. Metal Finishing, **3**, 91 (1953).
33. Cymboliste, M. Trans. Electrochem. Soc., **70**, 379 (1936).
34. Evans, D. J. and Hopkins, M. R. J. Electrodep. Tech. Soc., **28**, Advance Copy no. 8 (1952).
35. Gorbunova, K. M. Trudy Vtoroy Konf. Koorozii Metallov. **2**, 142 (1943).

Plating in the Automotive Industry: Its History and Development

By William M. Phillips

This is the second installment on automotive finishes. Part I appeared in the July issue.

From Radiator Shells to Grilles

There was a great increase in the use of conveyor equipment about this time. In fact, the cost of plating might well have been prohibitive had the large amount of hand work continued to prevail. Some of these units are six and seven hundred feet long. In other words, almost as long as the famous ship, the Queen Mary.

The conveyors worked on two different principles mainly. The use of chain lifts in one case and of arm lifts in others. The construction of tanks for plating has always been a problem and lead linings which were often used at this time, were a problem due to the fact that they picked up positive or negative charges from the solution and caused a considerable upset in the current distribution, as well as a loss of metal when the sides of the tank became coated. Rubber linings later eliminated this difficulty.

All during this period up to 1930 or 31, the radiator shell was one of the largest pieces and most prominent plated piece on the car. I will show here a picture of the 1928 Cadillac. In 1930, Cadillac came out with the V16 model on which, due to some difficulty with radiator shutters becoming plugged with flying pebbles, an added part was used known as a radiator grille. This grille was made out of square mesh screen pretty much the same kind of thing that is used for screening gravel, but it was put in a frame and was nicely plated. This grille caught on in the industry very rapidly. It was not many years before grilles were designed in many wonderful and fearful ways.

The grille as a plated part, replaced the radiator shell and added to the headaches of the platers. We had learned to plate any radiator shell the styling sections could come up with, but when it came to grilles, styling really went wild. One grille that I know of would trap a quart of plating solution every time it was withdrawn from a tank and some of the grilles had square section openings which were indeed most difficult to plate into. I am including a picture of a Studebaker grille which had to be plated with a specially shaped anode.

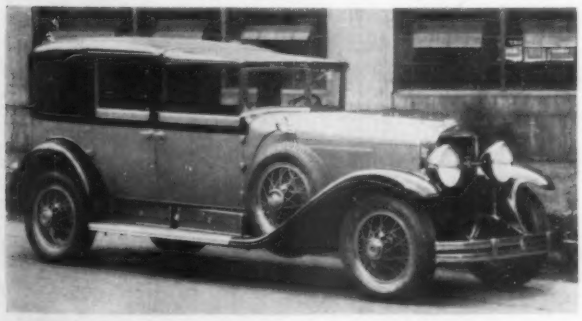


Figure 9. 1928 Cadillac Town Cabriolet.

Many of the early grilles were made of zinc base die castings. One of them weighed 27 lbs. However, there were other companies which used steel grilles and the steel grille has gradually replaced the zinc base die cast production.

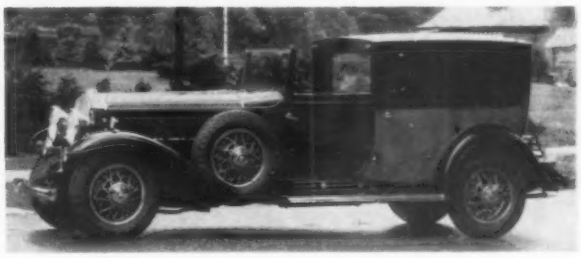


Figure 10. 1930 Cadillac V-16 Town Brougham.

Another thing that started to take place was the increase in the area of bumper bars. It was facetiously shown by a cartoonist — a bumper coming down the street with no car visible. It was not quite that bad. In fact, from an increase in plated decorative area, we all owe a lot to the styling sections for this increase in bumper size.

It had been the habit of all American manufacturers to harden bumpers. This was not true in England where it was a serious matter to bump a car with your bumper bars or attempt to push it in order to park. If you did such a thing, the English bobby would probably hand you a ticket, and the bumper bars would be bent.

I am getting ahead of my story a little bit when I mention that later on in this country, alloy steel was used and the hardening operation omitted. It is possible without too much effort, to dent the present day bumpers!

As time went on there was a considerable improvement in the plating on zinc base die castings. The early

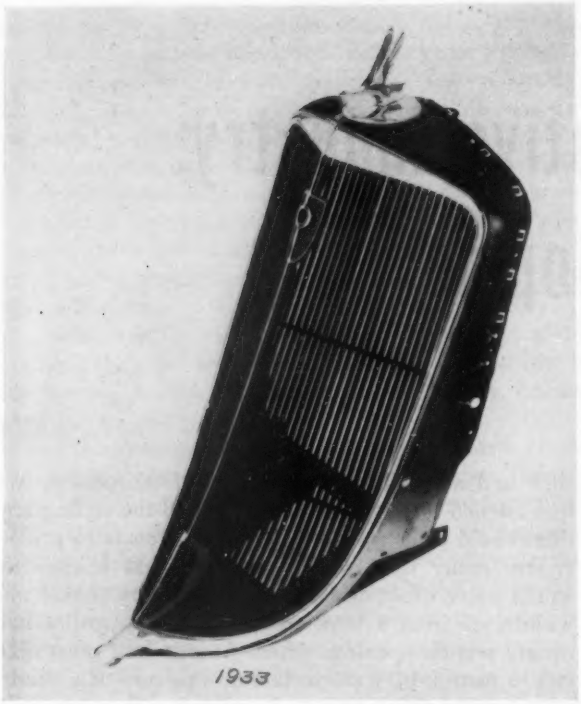


Figure 11. 1933 Studebaker steel radiator shell copper-nickel-chrome plated. One of the first big commercial plating jobs using auxiliary anodes. The auxiliary anodes were used on each side to plate the low areas on the 'wishbone."

plate had a very short life. Blisters were very common and the complete failure of exposed articles such as outside door handles, was very common in anywhere from four to eight months. Great improvement came about for two causes. One was the understanding of the people who made die castings, of the alloy requirements for good plating, and the improvement of the plating procedures themselves.

It has always been necessary, apparently, to copper plate zinc base die castings before nickel plating although various programs have been tried to use nickel only. As in plating steel, the plating of zinc base die castings requires a considerable thickness of protective metal underneath the thin layer of chromium plating. It does not seem feasible to plate even the best of die castings with thin plating and obtain any suitable durability, that is for outdoor exposure. For indoor use, rather thin plating can be used. In fact, it is my opinion that the only plate furnished by the motor industry which has been unnecessarily good are the die cast parts used in the interior of the car. With a wide variation in plate, particularly thickness of plate, due partly to specifications and partly to human error, it has not resulted in any appreciable number of failures.

During this period stainless steel came onto the market and there was a fear among the ranks of the platers that it would supplant plating in the motor industry. There were two designations for stainless steel in those days, one of them stainless steel and the other rustless iron. It has all since become stainless steel by name. The fact of the matter is, that the old stainless steel was a nickel-chromium-iron alloy and the rustless iron was a chromium-iron alloy. Tests showed that the rustless iron was not rustless and the stainless steel was not stainless. However, the stainless steel, containing nickel and chromium, could truthfully be said to be rustless.

Stainless steel did not, and has not, replaced plating, although there is a wide use of it on our cars. Stainless steel is only usable economically if the parts can be made of thin sections. It is obvious that a section as much as forty thousandths thick could be plated with three thousandths of an inch of protective metal and would be a good job, whereas the amount of non-ferrous metal required in such a thickness, provided alloy was used, would make the cost pretty high.

Stainless steel has been used extensively on such parts as moldings, hub caps, wheel discs and the like, and the type used for the purpose of economy has been the straight chromium-iron alloy; the so-called 16-18 which contains about 17% of chromium. This material stands up in use about the same as a good plated job. Examination of car parts in service shows this to be the case.

In the early days the Ford used a radiator shell made entirely of the nickel-chromium alloy, whereas their more expensive car, the Lincoln, used a chromium plated radiator shell. The color of the nickel-chromium alloy did not match the chromium plated parts and the color depreciated further on use so that considering the prohibitive cost, the shell was not adopted by other elements of the industry and was discontinued by all manufacturers.

Bright Plating

In the period of 1932-42, all of the developments about which I have previously spoken continued to advance. However, there came about a most important improvement in the art of plating in the way of bright plating. A large part of the cost of plating has not been the plating itself, but has been the manual work called for in polishing and buffing. The term polishing is used to refer to the wheel work or other abrasive operations used to get base metals sufficiently smooth to receive plating, whereas buffing is generally conceived to be the use of softer wheels to which abrasive is applied in stick or liquid form. The abrasive is generally of a much finer character than that used in polishing.

At the beginning of this period where copper and nickel plating was used in sequence, it was customary to buff one or both of these metals. In about 1935 there appeared a method discovered by Dr. Schlotter of Germany. This method was brought over by Mr. Girard who had been U. S. Ambassador to Germany. The method proposed by Schlotter was not the only method used. There were other methods, notably the use of cobalt in conjunction with organic chemicals as a brightener. It was also possible to produce *thin* coatings of bright nickel by means of additions of cadmium, zinc or lead.

The mechanism of bright plating most frequently involves the deposit of metal in laminar form instead of the usual crystalline deposit which results when deposits of nickel are made without addition agents. The scratch hiding ability of bright plating probably depends on this factor. It is pretty much like laying sheets of paper over a rough surface, or we might say pasting them over a surface. It is obvious that the surface, by this means, would become much smoother.

The industry first considered that the bright nickels

were of necessity too brittle, and some of them were. However, as the art of this kind of plating progressed, a sufficient amount of brittleness was eliminated so that the product was extremely practical. I can remember one instance where it was necessary to plate hub caps. That is, hub caps were made of steel originally, the steel portion being zinc plated and then a brass scalp was spun over it. The crimping or spinning operation was done after the scalps, or outer covers, were nickel and chromium plated and no appreciable cracking resulted.

It is hard to estimate how much money was saved by the elimination of the nickel buffing operations, but in one instance that I know of at the Ternstedt Plant in Detroit, there was a saving of $900 a day on one part. Not only was there a great saving in the application of bright nickel, but it was possible to produce better quality plate due to the fact that no nickel was buffed off after plating. This is particularly true of articles which have sharp edges which obviously would be more susceptible to metal removal than other pieces.

It was not at this time known what was later discovered, that deposits from certain cobalt nickel baths were plated in a highly stressed condition, the stresses measuring 60,000 lbs. and up. This caused cracking of the plate in use. It was discovered that heat treating would eliminate these stresses and consequently the consequent failures. It is an odd fact that heating deposits brightened with addition agents other than cobalt was very often deleterious to the quality of the plate. The methods of measuring stresses were developed by Graham and Soderberg, the Bureau of Standards, and by General Motors. Outside of the tendency of smooth bright plates to crack due to internal stresses, it was found that on panel tests very little difference could be found between the various bright nickels and for that matter, between bright nickels and nickel deposits without brightening agents. It was discovered that by carrying out certain controls, nickel plate could be deposited in compression instead of in tension.

In the early days of bright nickel plating, another great difficulty in plating was much reduced by the addition of certain wetting agents. The difficulty to which we refer is pitting largely caused by the adhesion of hydrogen bubbles to the surface of the article to be plated. This pitting was unsightly and further, it reduced the protective value of the plating.

Hydrogen peroxide was used for many years to reduce this tendency to pit but it was not always successful and overdoses of this material sometimes caused other difficulties in the process.

About the time of the inception of bright nickel plating, DuPont bought rights from the Germans to make a material which was one of the first of a type of wetting agents now very widely used for cleansing purposes. This material was first called Gardinol, but the name was later changed to Duponol. This material had the ability to reduce surface tension. I believe we can all understand why this works, as it simply makes it more difficult for the hydrogen bubbles to adhere to the surface of the article being plated.

Some years after nickel was being deposited in the bright form almost universally, it was desired by the industry to plate copper the same way. This was quite a problem due to the fact that normally copper deposits in columnar form and it was thought by some that this was an inescapable part of copper plating. Among those who worked on this was the organization with which I was connected and finally after a great many experiments and discouraging failures, a bright copper was evolved which plated in a true laminar form having a considerable scratch hiding ability. This depended on thiourea as the principal brightening agent. A paper was read at the time of the Dayton conference by Clifton and Phillips, outlining this process.

At the time of the second World War considerable use was made of this method by manufacturers to avoid the wasting of copper which had become a strategic material. In fact, the government prohibited the buffing of copper among other things. Since that time there have been a number of bright coppers developed and their use has been multiplying rapidly. Again, great savings have been made and the quality of the product improved due to the same reasons that applied in bright nickel.

Wartime Scarcities

This brings us up to the period of the second World War and I should like here to discuss some of the government regulations which went into effect. The first part of 1942 was the last manufacture of automobiles during the second World War period and at that time there was a long list of prohibited articles and a short list of permitted articles, for use on our automobiles. As a result, the models turned out then were referred to as "black-out" models. About the only bright part permitted was for bumper bars and bumper parts with the further exception of door handles. There was also insufficient nickel to do the plating properly and very inferior plates had to be used by the industry. I wish to italicize that it was not the desire of the industry to put out this kind of work but it was made necessary by government regulations and the scarcity of nickel.

At one time it was contemplated to turn out models with no plating and I can well remember the day when the entire General Motors line was finished experimentally with no bright parts at all, and I must admit that these cars looked pretty good — entirely too good for my personal comfort. However, the triumph of the all painted car was very short as it was found that paint has no "shine through" as does plating so that a car finished in this way, if driven for any time at all, looks like a very ancient vehicle. This is not true of a car with highly finished plated or metal parts. This was amply illustrated when the war was over by the sales departments of the industry. It was rapidly found that the "black-out" models made in '42 brought less money on the second-hand market than did the cars manufactured in 1940 and 41, when plating was used.

It is within all of our memories when dire predictions were made for the plating industry at the onset of this war and it is also quite an agreeable fact that these predictions of dire consequences did not take place. As a matter of fact, the plating industry, even with the motor industry shut down, increased greatly during this period and was very instrumental in producing the materials of war.

Without regard to time sequences, I think it would be interesting to talk about our automobile headlamps and the part plating has played in their development. You will remember that I mentioned the plating of wick holders with nickel in the old kerosene lamps. As the lamp developed into a more useful stage, it had to have reflectors. Some of these early reflectors were made of glass coated with silver so as to produce a mirror. Later, however, the reflectors became much more scientific and were made with parabolic shapes to effectively reflect light.

In the early days the light was furnished by kerosene lamps; later by acetylene gas, and from then on up to the present, by means of incandescent lamp bulbs which were lighted with electricity from the car batteries.

For a long time the reflectors were made of brass which was nickel plated and then silver plated. A final buffing operation was put on, buffing both the silver and the nickel together. This made a very good reflector but in order to get good use from it, it was necessary to have a very tight seal on the lamp doors which held the lenses. Various devices were used to get a good seal. However, the seal was never entirely effective and there was always some depreciation of the reflective ability of the reflectors themselves.

As time went on there was a development which eliminated plating as such from the headlamps used in automobiles. This process was the coating in vacuum of almost any object it was desired to coat. In the case of the reflector it became metal on glass and resulted in the sealed beam headlight with which you are all familiar. A modification of this process was used by one company who made their reflectors of metal. These reflectors were subsequently coated with lacquer and then received a coat of reflective metal deposited in vacuum. Of course, this reflector had to be sealed in just as carefully as one made of brass with the nickel and silver deposit.

Somewhere along the line in the development of plating there was an attempt to make parts of aluminum and depend on plating for their protection and utility. In some cases aluminum was used even without plating. I am sorry to record that the aluminum without plating did not work out successfully. This was tried by Chevrolet who made both radiator shells and lamp doors of aluminum alloy which was supposed to be quite resistant to atmospheric conditions. In a matter of a year or two there was so much trouble with this material that it had to be abandoned. Later on there was an attempt to use plated aluminum on hub caps. One instance of this was the Buick Division of General Motors and I can say from personal experience, that this was most disastrous. The plating itself seemed to be quite successful and the product would resist accelerated tests quite well. However, when the hub caps were used on the car, failure always took place in from six to nine months depending on what part of the country the product was used in.

Various attempts have been made, and are being made, to successfully plate aluminum and, in the writer's opinion, this is a most important endeavor due to the fact that aluminum is one of our most plentiful metallic elements in the earth's surface and the price and supply of aluminum will both be favorable whereas the availability of copper and nickel do not present such a favorable picture for the future. In writing this, I am aware that there are a number of processes pretending to be able to plate aluminum quite successfully for outdoor exposure. It is possible that at the present writing one or more of these may have achieved success. It is also true that for interior use, plated aluminum, when properly plated, should be quite successful.

We now come to the period of the post-war development of the plating industry and a word about the scarcities of materials and government regulations in effect during the second World War. I will deal with the latter phase.

Nickel was the metallic element in greatest scarcity from the platers' viewpoint. Copper was also scarce, and as we came out of the war, the industry found itself in rather a deplorable condition brought about by the scarcities. There were some rather ridiculous regulations made by the government during the early part of the war when plating was still permitted on some parts of automobiles. One of these regulations was to the effect that any bright moldings would have to be painted and the surface treated in such a way that if the customer removed the paint these surfaces would not be shiny. This was referred to by the automobile industry as an example of "hair-shirt" regulations.

The government even went so far as to require or advise, the removal of nickel from nickel solutions and some solutions were actually treated in this way at a tremendous cost for the small amount of nickel recovered. In other cases the nickel solution was pumped into tanks and preserved for the happy day when the war would be over. Some of these tanks were not suitable for nickel solution storage which either resulted in the contamination or loss of the solution. However, it did give us a start. Nickel was still scarce after the war was over and the writer found that nickel was sold to one of our allies under lend-lease and then was being sold back to the United States at a large increase in price.

There was also a scarcity of chromic acid and various methods for extending the use of chromium plating solutions and even the recovery of chromium solutions which had been used for World War II was not uncommon.

The 1946 automobiles were the first cars to appear after the war and they were naturally in terrific demand, and this demand has lasted in nearly unabated form up to the present, in spite of the vast increases in the production facilities of the various motor companies.

The metal supply conditions corrected themselves in a matter of a few years. You might say that from 1948-50, and perhaps '51 or part thereof, the very best plating was done by the industry which has been done up to this time. This, due to the greater thicknesses of metal used in deposits and to advances made in the preparation of the base metal which constituted the parts. The plating industry has never found a substitute for relatively thick metal deposits. Theoretically, there would be no requirement for any very great thickness at all, if the surface of the base metal were

perfect and a deposit of metal over this surface were free from porosity.

I have often remarked in talks that the plater did a pretty good job in plating from a percentage viewpoint. Out of a square foot of plated area containing 144 sq. in. there was only 1 sq. in. of bad plating. The difficulty, however, is that this square inch is distributed all over the 144 sq. in. in small holes and defects. The reason thickness is required is that the thicker the deposit, the smaller become the pores which might be caused by surface defects or the effect of hydrogen.

There developed a well known controversy in the plating of steel with copper and nickel or nickel only. The test panels which were exposed on the test fields of ASTM seemed to indicate rather clearly that all nickel was more durable than copper and nickel. Also, from theoretical cases, you might be able to arrive at the same conclusion. However, it is not uncommon in scientific work when something happens and you are sure of the results, to explain these results by some very nice and convenient theory. In this case, however, it was found by surveying the performance of parts of cars for a period of years and in great numbers, that the results indicated by the test panel results did not work out in practice. It was found that parts plated with equal thicknesses of copper and nickel or all nickel had about the same useful life on automobiles.

I will not attempt to explain just why this is. There are, however, notable differences in the use of plated parts on cars and the type of exposure which one might get by exposing panels on racks. One of these differences is that the diligent owner of the car may wash his car once in a while and wax or oil the parts which were plated. This makes a tremendous difference. In fact plated parts, if given an occasional coat of oil which is removed insofar as the user can see, will stand up satisfactorily. I should say, *if* they are reasonably well plated.

Allocations and Regulations

As time went on the emergency in Korea brought about another era in which metal scarcities showed up and Washington was again occupied by people having to do with controls of scarce metals. The NPA set up regulations modelled to some extent after the regulations which were in effect in World War II. The motor industry was placed on an allotment basis. Some of the most important things being allotted were steel, aluminum, rubber, copper and nickel. The allotments of steel were such that the amount of steel allotted to each element of the motor industry determined how many cars and trucks it could build. These allotments were based by NPA on previous sales experience so that it was developed on a percentage basis what amount of cars could be produced by each company.

One of the most awkward things in plating was the permitted and prohibited list of articles which could be plated and second, the small amount of nickel which was available to plate these articles. The NPA authorities had to feel their way and, in the beginning, nickel was distributed largely by the suppliers of this metal. Later on as nickel became more scarce, partly due to its rather large use in the manufacture of jet engines and its requirement by the Atomic Energy Commission, it became impossible to produce really good plating.

Copper was never too much of a problem during this war, but nickel was so hard to get that it was entirely omitted on certain plated parts of the car. The grilles, for instance, were plated with copper on which chromium was deposited directly. In order to improve the durability of this plate clear baked lacquers or enamels were used. This, of course, is the reason for the warnings issued by the industry to its customers regarding the use of these parts.

It would appear from the experience which the plating industry had both in this emergency and the one in the second World War that a good substitute for nickel plating would be one of the most desirable things we could have. It has not been for lack of effort that such substitutes have not been fully developed. Various things were tried. For instance, white brass, which is a combination of copper and zinc, was given a thorough try-out and was used to some extent either with or without a subsequent chromium plating. Deposits of antimony or antimony alloy were also used, but nothing to date has equalled the program of using copper and nickel or nickel only as the undercoatings for chromium.

You might ask what is wrong with the clear lacquers or enamels. They do greatly extend the life of the plated article, but no such program has ever resulted in a product which would last as long or as satisfactorily as the old schedule of sufficient thickness of copper-nickel or nickel-chrome. For one thing, the effect of moisture on all organic coatings is very bad and the inability of these coatings to stand abrasion is still another important factor meditating against their continued use. It is improbable, I think, that we will, in the immediate future anyway, be able to use thin coatings of plate coated with clear organic coatings.

It would seem that the plating industry all over the country met this situation with a great deal of industry and ingenuity even if the customers did not get as good plating as they had become accustomed to. It can be said that it was no fault of the automobile manufacturers or the platers that the quality of the product went down during this period.

I am pleased to announce that at the writing of this article, that the NPA controls on nickel have been removed. This by no stretch of the imagination, indicates that there is plenty of nickel. It is still scarce and high priced. It might be mentioned that all during this period there was rather a large amount of black market nickel available to those who were willing to pay for it, thus indicating some degree of inadequacy on the part of controls although the writer had first-hand experience in Washington during eight months of NPA operation, serving as chairman of a group of executive motor industry engineers and also in the motor section of NPA. I think all my fellow NPA workers will agree that an assignment to a job of this type is pretty tough. Most everybody worked hard to try to get something done for the industry they were representing. However, it was pretty hard to do. Some improvements were made but I think everyone will agree that we are better off generally, without controls of this sort than we are with them.

(To be concluded next month)

Surface Treatment and Finishing of Light Metals

Part IV. Chemical Cleaning and Pre-Treatment Processes

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M., and R. Pinner, B.Sc.

IT is hardly possible to exaggerate the importance of the efficiency of the preliminary cleaning process as a preparation for almost every type of metal finish. The reject figure in a metal finishing shop is often greatly dependent on the efficiency of the cleaning cycle. Often an additional operation or a change in the composition of a cleaner, or even a more effective rinsing method will cut down or eliminate a rejection percentage that has come to be looked upon as almost inevitable. Frequently this is achieved without any noticeable change in the appearance of the cleaned surface.

Nor does the importance of the cleaning procedure stop at reducing rejects. The durability of electroplated or organic coatings may vary from a matter of weeks to years, depending primarily on the efficiency of surface pretreatments. Faulty cleaning is probably responsible in the user's mind for much of the prejudice against the value and permanence of almost all types of metal finishes. In quality finishing, it pays to supplement chemical control of the actual finishing procedure by laboratory tests for each step in a cleaning cycle, and performance tests on the finished article (for example, for adhesion, corrosion resistance, etc.) to confirm that the cleaning technique is adequate.

Cleanliness

In metal finishing, a differentiation is often made between *physically* and *chemically* "clean" surfaces. Physical cleanness in the sense of apparent freedom from solid dirt, grease, or other contamination is, in general, insufficient to ensure either the successful application of a finishing operation or maximum corrosion resistance.

Chemical cleanness, or the absence of any contamination, is often confused with a "water-break-free" surface, i.e., the ability of the metal to be "wetted" by water. While freedom from water-break on rinsing often constitutes a rough guide as to the presence or absence of insoluble oils and greases, etc., it depends on the surface tension of the contaminants and the thickness of the water film, and may be obscured by evaporation, or the presence of lyophylic "wetting agents" on the metal surface.

When designing a cleaning cycle for a finishing operation, or when testing the efficiency of different cleaners or cleaning conditions, it is often desirable, therefore, to test the cleanness of a metal surface in some more definite way. An outline of a few such methods is given below:

FLUORESCENCE TEST:

Mineral oil fluoresces brightly when subjected to ultra-violet light. Oils and fats of animal or vegetable origin do not fluoresce naturally but can be made to do so by addition of an oil-soluble fluorescent dyestuff.

The article or test panel is therefore treated with such a dye and photographed under ultra-violet light after the standard cleaning procedure which is to be tested. Clean metal appears black and cleanness is inversely proportional to the amount of fluorescence.

WATER-SPRAY TEST:

This is an interesting test method which has been developed for aluminum-alloy surfaces. A test panel is covered with a fine spray of water which condenses as droplets on oil-covered areas, providing a pattern which will remain constant for sufficient time to allow a sketch to be made of the surface. Preliminary cleaning and rinsing is carefully controlled and the efficiency of a cleaning procedure on various forms of contamination may be studied by performing the tests on panels immersed in various oils by a specific dipping and drainage technique. The pattern is drawn on a paper divided into 100 squares and the cleaning efficiency calculated from the average value of five determinations, depending on the number of squares covered by condensation.

The method is claimed to be reproducible. In the original experiments, individual results deviating from the mean by more than three times the standard deviation were discarded.

THE ATOMIZER TEST:

Among several variations of the spray methods, the atomizer test recently developed by Linford and Saubestre[32] is the most important. Here a specimen consisting of a central rectangular part 2″ wide and 3″ long with a tongue ½″ wide and 3″ long at the top, and a triangular section at the bottom, was designed to give uniform drainage. The equipment consists of an ordinary atomizer worked from a compressed air line. Distilled water to which a dye may be added is sprayed on the specimen after the latter has been cleaned, rinsed and allowed to dry at room temperature. The pattern may then be sketched or, alternatively, the panels are dried by a heat lamp as soon as spraying is complete which fixes the pattern and allows tracing. This test has been found to give good results under shop conditions, and to be rather more sensitive than previously developed spray-pattern methods.

Other Surface Conditions

The cleanness of a metal surface is only one aspect of the influence of the condition of the basis metal in the application of surface treatments. The most im-

portant properties required of a cleaning cycle for the pretreatment of aluminum-alloy surfaces are given below, but it is important to consider the fact that the various finishes may require different physical surface conditions.

POROSITY:

Aluminum castings showing surface porosity present special problems to the finisher. In some cases, superficial pores may be closed by metal flowing during polishing; in other cases castings may have to be rejected. Contamination remaining in the pores adversely affects the corrosion resistance of the metal and the adhesion of a coating. Cleaning solutions possessing a low surface tension and good pentrating power will greatly counter this type of contamination, while hot-water rinses may be beneficial in opening the metal pores and facilitating cleaning.

ALLOY COMPOSITION:

The effect of alloy composition on the individual finishing processes will be discussed in due course. With a few exceptions, little difference is encountered, however, in the cleaning of various alloys. In general, it is slightly easier to obtain permanent coatings on aluminum and the more corrosion-resistant alloys, e.g., those containing only manganese, magnesium, silicon, etc. With adequate cleaning, however, no trouble is experienced with the more susceptible, high-strength alloys.

In alkaline cleaning, alloys containing copper, manganese or silicon are left with a black surface scum, due to insoluble compounds of these metals. This scum can normally be removed from the alloy surface by a nitric acid dip or, in the case of silicon, by a mixed nitric acid-hydrofluoric acid solution.

SURFACE SMOOTHNESS OR ROUGHNESS:

Some finishes, e.g., sprayed metal, require preferably a rough, "toothy" surface for optimum adhesion, while reflector electropolishing processes require a highly polished, smooth surface. Anodic oxidation treatments are usually applied to buffed surfaces, though the requirements are not so critical. Different types of electroplating techniques will be discussed later; in one, the plate is applied to the anodized surface, while in the others a zinc coating is applied directly to the virgin surface. In the latter processes, the surface is slightly etched in order to remove unsound surface layers. The old theory that electroplating on aluminum requires a rough "key" has recently been reconsidered. Providing the surface is sound and clean, adhesion of the coating equal to the ultimate tensile strength of the metal may be obtained on smooth lustrous surfaces.

The different surface conditions outlined above are produced chiefly by mechanical treatments. Different surface structures are obtained, however, by chemical means also. Rough, frosted surfaces are sometimes used for organic finishes, obtained by uninhibited alkali dips, while various degrees of etching ranging from microscopic to the visible are produced in acid solutions.

Functions of a Cleaning Cycle

The factors determining a successful cleaning cycle are complex. Processes may be required to fulfil the following requirements:

The removal of unsound surface layers, e.g., corrosion products, etc., with the production of a clean, uniform surface which may be either smooth and lustrous, or rough and "toothy" as required.

The removal of lubricants used in forming aluminum, by rolling, drawing, stamping, threading, etc., as well as quenching media used in heat treatments. These lubricants may be (a) fatty compounds of vegetable origin, e.g., cottonseed oil, palmseed oil etc.; (b) of animal origin, whale oil, lanolin, etc., or (c) aliphatic or aromatic mineral oils, e.g., paraffin hydrocarbon oils or benzene derivatives. The oils may be either unmixed or present as emulsions, in which case they are usually combined with soap. In other cases they have been rendered water-soluble by sulphonation. Colloidal graphite, sulphur and metallic soap may be present to assist lubrication. Removal of the following may be required:

1. Protective oils and greases, which may be of similar composition as forming lubricants. Lanolin or petroleum jelly is often present to prevent oxidation.
2. Polishing compounds, e.g., stearin and paraffin waxes, containing abrasive and absorbent material, e.g., fine silica, diatomaceous earth products, lime, colloidal clay, etc.
3. Handling grease, fingermarks, etc. These are mainly fatty acids and nitrogenous compounds.
4. Dust, metal chips, solid dirt, foreign matter, etc.
5. Alkalies and acids from the surface to prevent corrosion.
6. Welding or brazing fluxes, corrosive salts and welding or annealing scales after welding.
7. Moisture, particularly before the application of organic coatings to prevent corrosion taking place between the coating and the metal.
8. Faulty organic coatings, e.g., paints, lacquers, etc., or organic coatings applied for corrosion protection during storage.
9. Faulty electrodeposits for refinishing.
10. Oxide films or faulty anodic or chemical coatings.

Cleaning Methods

Many processes are commonly used in cleaning aluminum, depending on the work and the nature of the contamination, but the choice of a particular cleaning cycle cannot be laid down in hard-and-fast rules. The aim, to obtain a chemically clean surface with the greatest economy, must in each case be suited to the job. Suggested cleaning cycles will be given subsequently in this article and in later articles where they are an integral part of a finishing process. The important factors relating to industrial cleaning operation are indicated below.

HAND SOLVENT CLEANING:

This method is applied only to articles too large for

immersion, or where special attention must be given to lapped joints, rivets, holes or seams, etc. It may be carried out with swabs and organic solvents helped by wire brushes, and care must be taken that no oil pockets are allowed to remain to seep out in later processes. A minimum of two operations is required: the first, to remove the contamination, the second, to remove the final grease film. Dull or corroded areas may be shot- or sand-blasted or treated with a wire brush before cleaning.

Among the solvents used, the safest is kerosene, due to its high flashpoint. It is, however, slow in evaporating and is liable to leave an oily residue. It is used, therefore, mainly in preliminary operations for very dirty work. If contamination is only slight, a mixture of equal volumes of white methylated spirits and medium-grade coal-tar naphtha may be used.

Other solvents in common use include cellulose thinners, turpentine, heavy benzene, and white spirits, the last three being, however, irritating to the skin. Gasoline is too inflammable for these applications, while chlorinated solvents should not be used due to their toxic properties.

In addition to organic solvents, other hand-cleaning processes will be described under acid cleaning.

Vapor Degreasing:

This cleaning process removes oils and greases as well as solid dirt particles from metal surfaces and is widely used in between processing stages, as well as a precleaner before finish operations. Vapor degreasing, however, will not produce a chemically clean surface and is usually, to this end, supplemented by alkaline cleaners.

Non-inflammable chlorinated hydrocarbon solvents are employed, the most common of which is trichlorethylene. Methylene chloride which possesses a lower boiling point and is more difficult to control is used on the European continent, while tetrachlorethylene, (also called perchlorethylene,) is being increasingly used in the U.S.A. Other solvents of the group find a more limited application.

Trichlorethylene boils at 188°F. and has a density of 1.5. It is non-inflammable and has a low specific heat (approx. 0.25) requiring correspondingly little heat to raise its temperature. Its vapors are approximately 4½ times as heavy as air, which makes them easily controllable in the degreaser. These must, however, be fitted with condensing equipment, as the vapors are toxic at concentrations of 2,000 p.p.m. and fatal at 4,000 p.p.m. In the presence of burning cigarettes, etc., it decomposes into the extremely poisonous phosgene gas. Owing to its low surface tension, and its consequent easy penetration into pores, seams, and crevices, etc., trichlorethylene is useful in the cleaning of complex and porous work.

For use with aluminum and its alloys, trichlorethylene must be "stabilized" to prevent the corrosive effects of decomposition into hydrochloric acid. This reaction is photochemical in nature and is brought about by ultra-violet light, aided by the catalytic action of acids present in solvent-forming oils, etc. The stabilizing agent is added to neutralize the acid as it is formed and to set up a safety margin of alkalinity. An aliphatic amine, or a mixture of amines, possessing a boiling point slightly higher than the solvent, is commonly used in concentrations of 0.1 per cent. Solvents are obtainable stabilized according to specifications.[3] To eliminate water which catalyzes the decomposition of the solvent, small bags of sodium carbonate or other hygroscopic material are sometimes placed in the tank.

Degreasers may be of the one-, two-, or three-compartment types, or may include solvent sprays. The most effective are those combining solvent liquor, vapor and spray, and these will deal effectively with all types of contamination except soap-emulsions or heavy soap-base drawing compounds which are only partially removed.

A common type of degreaser has three sections, two for immersion of the work in solvent liquor, the third for a final vapor clean. The work is immersed in the first tank for about one minute, removing dirt, turnings, heavy grease and oil. In the case of polished articles, the hot liquor dissolves the grease bond and liberates the abrasive from the surface, the agitation in the boiling solvent dispersing the composition. In the second compartment the work is rinsed for approximately 15 seconds prior to the vapor cleaning. The solvent in this section is sometimes cold in order to cool the work to improve condensation in the vapor stage. After rinsing, the work is held in the third section for 15 to 30 seconds where the condensing solvent vapor washes off oil and grease. To keep the work cool enough for solvent condensation, metal with a high rate of heat transfer is frequently immersed several times rather than treated by one long immersion in the vapor.

Degreasers may be fitted with conveyors and such units usually include a spray section, useful for treating work contaminated with soap-base compounds. Other units may operate with a continuous recovery process. By one method, contaminated solvent is gravity fed from the sump of the degreaser into an external still, operating at a higher temperature than the degreaser itself, returning the distillate direct to the tank.

In the simpler type of unit, the degreaser must be stopped and the solvent distilled from one section to another, according to the type of machine. The tank is then scrubbed out with sodium-carbonate solution and dried thoroughly before refilling. The frequency with which the tank is cleaned depends on the rate of contamination, and should not generally exceed two weeks. The degreaser should, however, be cleaned out when the boiling point of the solvent has risen to 200-204°F.

Steam Emulsion Cleaning:

Emulsion cleaners are a comparatively recent development, and gained a large impetus during the late war when chlorinated solvents were scarce.

The function of emulsion cleaning is similar to that of vapor degreasers, which they may replace. They have the advantage of dealing rather more effectively with solid dirt and water-soluble materials such as soaps and sulphonated oils. They are quick working and may be used at room temperature, they require a minimum of equipment and space, but, like vapor degreasers, they do not provide a chemically clean

surface and, if this is required, emulsion cleaning should precede treatment in an alkaline cleaner.

Emulsion cleaners have no action on aluminum and are extremely flexible in the choice of solvent, control of alkalinity and metal to be cleaned.

There are three methods which may be employed:

In the first case, the cleaning liquid is in two or more phases which are generally immiscible, one of which is an aqueous solution, the other an organic solvent which should have a flashpoint above 100°F. The latter may be mineral oil, kerosene, naphtha or benzene, etc.

The two phases are separate, i.e., one floats on the other and, by dipping the work in the cleaning medium, the work is in contact alternately with the aqueous and the non-aqueous phase.

The surface tension is reduced and wetting facilitated by the use of detergents containing groups possessing an affinity for the two phases. An example of this is triethanolamine and oleic acid. As well as forming the soap, triethanolamine oleate, a proportion of the triethanolamine goes into solution in the water, while part of the oleic acid dissolves in the organic solvent, e.g., mineral oil.

An example of this type of cleaner may contain by volume:

Kerosene	8.0 %
Triethanolamine	0.25 "
Oleic acid	0.5 "
Pine oil	2.25 "
Water	89.0 "

It has been suggested that those parts of the soil which are soluble in aqueous solution will be removed together with parts soluble in the organic solvent.[4]

In the second process, the cleaning is done in two stages. The work is first sprayed with or dipped in the non-aqueous solvent which, in the latter case, should preferably be agitated. Care must be taken to keep the work dry before immersion. As in the di-phase cleaner, a soap is added to aid emulsifying properties on rinsing, and the solution may consist of approximately 5 to 10 per cent of a suitable soap dissolved in the organic solvent. Examples may include triethanolamine in mineral oil, or sodium naphthenate in cresol. A white, milky film is formed on the surface, and the work is transferred to a water rinse, where the solvent and contamination are washed off.

The cleaning process itself takes place in the rinse, hence there is little contamination of the cleaner. A hot-water rinse is most effective or, in other cases, an alkali cleaning bath may be inserted before the rinse.[5]

The third process uses a similar solution to the di-phase cleaner in washing machines of the pressure-spray or rotary-tumbler type. Here the temperature is raised to 140 to 190°F.

Solvent emulsions loosen the bond between the contamination and the metal surface, and the solid dirt particles are left coated with a soap or wetting agent. The deflocculated particles are easily rinsed off and the cleaned surface is physically but not chemically clean. For the application of enamels and for storage purposes, emulsion cleaning may often be sufficient. In other cases, a further alkali cleaning operation is necessary.

Burning Off:

This process may be used for cleaning aluminum sheet where the contamination is oxidizable by heat and where the metal will not lose its mechanical properties at elevated temperatures.

The sheet is coated on both sides with a petroleum hydrocarbon solvent[6] boiling initially at 160°F., and with an end boiling point of 380 to 382°F. A coating machine with a loose scraper bar may be used for the purpose which allows both sides to come into contact with the solution. When coated, the sheet is passed into a tunnel oven by means of a conveyor belt, where it is kept at a peak temperature of 420 to 450°F. for about five minutes. The solvent dilutes the grease and spreads it out over the surface in a thin film, from which it oxidizes and burns off.

Acid Cleaning Treatments

Various treatments using acid solutions are available for different purposes, the three which are most important being the use of mixed acid baths for cleaning prior to the application of organic and electroplated coatings, acid dips for use after alkaline cleaning, and the use of an acid bath for design etching. The pretreatment before welding and the removal of welding fluxes will also be discussed.

Acid Etches and Pickling Solutions:

The function of these acid solutions is to remove unsound surface layers and oxide films, "burnt-in" oil, etc. In cleaning they should be preceded by vapor degreasing or emulsion cleaning to avoid excessive contamination.

Prior to painting or plating a fresh aluminum-alloy surface, a chrome pickle is frequently employed. These employ solutions containing chromic and sulphuric acid in various proportions; two recommended are:[7,8]

(1)	Chromic acid	10.5 oz.
	Sulphuric acid	1.4 pints
	Water	1 gallon
(2)	Chromic acid	175 g./l.
	Sulphuric acid	35 "

The article is immersed for ½ to 2 minutes at a temperature between 140 and 160°F., a clean, slightly etched surface being obtained suitable for the application of paints or zinc-immersion coatings. The chrome-pickling operation is usually preceded by degreasing and a mild-alkaline treatment to remove heavy oils, greases, dirt, etc., and is frequently used to remove heat-treatment films and to prepare aluminum alloys for zinc-immersion plating, anodizing and chemical treatments. It helps to eliminate surface irregularities caused by oxide inclusions or embedded buffing particles and does not, in general, remove as much metal as caustic soda, while it leaves the surface clean and semi-bright. The acid may be used in tanks of stainless steel (18-8 stabilized), stainless steel-clad material, or lead-lined or other acid-resistant materials. The solution may also be used at room temperature if the immersion time is increased to four to five minutes.

Instead of a chromic pickle, a light etch in a nitric-hydrofluoric acid solution may be given. This process has been investigated by Bullough and Gardam,[9] who used it to obtain adherent nickel electrodeposits using

the zinc immersion method. The solution recommended contains by volume:

Hydrofluoric acid (40%)	10%
Nitric acid (sp. gr. 1.42)	10 "
Water	80 "

and may be used at room temperature (20°C.) in plastic containers. The work which has been degreased prior to etching is immersed for two to five minutes.

Aluminum is passive in nitric acid and the etch removes weakened surface layers by selective dissolution of the alloying elements from the surface leaving a very thin pure aluminum layer, covered with a very thin, adherent oxide coating. The surface is etched metallographically, and reveals the crystal planes in contrast to the pitted surfaces produced by other etching solutions.

The time of the etch is not critical. A minimum of 15 seconds will remove flowed or shattered layers of metal and expose the grain structure. Further attack is concentrated on $CuAl_2$ particles in copper-containing alloys and no serious roughening is obtained until the work has been immersed for 10 minutes. The thickness of metal removed varies with the copper content and averages 0.00022 in. per min. for duralumin, very much less metal being dissolved from commercial aluminum. None of the acid solutions, except those containing hydrofluoric acid, will deal effectively with high-silicon alloys. While silicon and silica derived from $MgSi_2$, etc., in the low-silicon alloys can be dealt with by the solution given above, alloys containing 10 per cent or more silicon leave a gray surface and require special treatment. For this purpose, Bullough and Gardam recommend that high-silicon alloys be treated first in the main solution for 10 minutes, after which they are rinsed and immersed for four minutes in a solution containing:

Nitric acid	98%
Hydrofluoric acid	2 "

before the application of a zinc coating.

Manganese-containing alloys do not require this last dip but should also be given 10 minutes in the main etch.

The time of treatment, as well as depending on the alloy composition, should vary with the required state of the surface. If no roughing is required, a 30 second immersion may be sufficient. To obtain a microscopic etch exposing the crystal planes and giving the best base for subsequent deposits, slightly longer times may be required. The latter method gave adhesion of nickel deposits approximately equal to the ultimate tensile strength on commercial aluminum, as well as alloys containing magnesium, silicon, manganese and copper; the complete cycle being: degrease — etch — rinse — (acid dip) — rinse — sodium zincate immersion — rinse — copper or brass deposition — rinse — nickel deposition. The maximum adhesion was obtained irrespective of the roughness or smoothness of the surface, showing that no benefit is obtained by producing a rough "key" for zinc-immersion plating.

As will be seen later, solutions containing nitric and hydrofluoric acid are also employed in whitening aluminum-alloy surfaces after alkaline treatment.

For the purpose of providing a good surface for organic finishes, phosphoric acid solutions may be employed, which produce in addition a thin film of aluminum phosphate which aids corrosion resistance and is a good paint base.

One such process[10,11] employs a mixture of phosphoric acid and alcohols, the latter acting as grease solvents as well as wetting agents, emulsifying agents, etc., to aid cleaning. A typical standard formula contains by volume:

Orthophosphoric acid (85%)	10%
Butyl alcohol	40 "
Isopropyl alcohol	30 "
Water	20 "

The solution may be either brushed onto the surface or used in a dip tank. In the former case, the work may be scrubbed thoroughly to dissolve grease or oil and the solution is allowed to remain in contact with the surface for approximately one minute. While the surface is still wet, it is wiped immediately with two cloths to clean and dry it. If the solvent has begun to dry on, it must be re-wetted, and care must be taken not to treat too large a surface area at one time. Crevices, lap-joints and seams should be dried by a stream of air, and a dry surface is recognizable by the formation of a fine white layer of aluminum phosphate. If the work is dipped in the solution, it should remain in contact for 5 to 10 minutes, after which it may be rinsed and dried at 300°F. Due to the irritant nature of the solvent, operators should wear rubber boots, gauntlets and aprons, and, preferably, goggles.

Several proprietary cleaners similar to that given above are available, and mixtures recommended include phosphoric acid as well as monobutyl ether or ethylene glycol and a soluble salt of an alkylated naphthalene sulphonic acid as a wetting agent;[12] an alkali metal fluoride and metaphosphoric acid or ammonium dihydrogen phosphate;[13] and mixtures of a soluble bisulphate and sulphate to which ammonium monohydrogen phosphate and an organic sulphonate have been added.[14]

Acid Dips Associated with Alkali Cleaning:

If, before alkali cleaning, the aluminum surface shows the presence of corrosion products or local spots, due to chemical attack or faulty storage, etc., these areas may etch during the cleaning cycle. The formation of a protective film during alkali cleaning will be prevented and the metal attacked by the alkali. To prevent such etching, the metal may be dipped either in a 6 oz./gal. solution of sodium bisulphate ($NaHSO_4$) or in a cold 70 per cent nitric acid solution before alkali treatment.

After cleaning in hot alkali, or after a caustic soda etch, a black smut will be found on the alloy surface, consisting of copper, silicon and manganese particles, etc. The most common treatment to whiten the surface preparatory to finishing operations is by immersion in nitric acid, with the addition of sulphuric or hydrofluoric acid, the latter being essential for the removal of silicon or silica. For whitening copper-bearing alloys after alkali treatment, a short immersion in nitric acid is sufficient, various concentrations of acid commonly used ranging from 20% by volume to the con-

(*Continued on page 97*)

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Black on Nickel Plate

Question: We are engrossed in the problem of obtaining a black coating on nickel silver or on nickel plated brass or steel. The black coating should be removable or relieved by either barrel tumbling or hand polishing. We have obtained excellent results of black on brass by utilizing the copper carbonate-ammonia process and have tried the same process for black on nickel with no results. The closest finish to black on nickel that we have been able to obtain has been a blue and that is wholly unsatisfactory.

We are enclosing samples of the black on brass and the blue on nickel finish, and would appreciate your advising us as to equipment necessary and the process involved in obtaining the desired black on nickel finish.

B. J.

Answer: A good black, suitable for relieving on nickel, is produced by arsenic plating. Formula and procedure will be found on page 233 of the 1954 edition of the *Metal Finishing Guidebook-Directory*. The plating can be performed either in a still tank or in a barrel.

Lacquering Chromium Plate

Question: We remember seeing an article in a not too distant issue of your magazine dealing with a method of preparing a nickel chrome plated surface to receive paint, and will greatly appreciate your sending us the copy, if available, in which this article appeared. If not available, kindly advise the volume and number, as we might find we still have this particular issue.

E. J. F.

Answer: The item appeared on page 77 of the March, 1952 issue of METAL FINISHING. In substance, the procedure involves immersion in a 2% solution of chromic acid at 150-160 deg. F. The articles can be rinsed, but practice seems to favor allowing the solution to dry on the work prior to lacquering.

Ammeter Shunt for Tank

Question: What size shunt do you use, a size for the top capacity of tank rheostat or a size for the top capacity of power unit?

M. J. H.

Answer: Shunts should be of no greater value than the current capacity of the rheostat. Power sources can be of any size and, if a small rheostat is being used on any particular tank, overloading the rheostat will cause the resistors to burn out.

Free Cyanide Determination

Question: Can you advise of a method to determine the "free" sodium cyanide and caustic, the zinc content in a bath containing Sn, Cu and Zn (to deposit a special ternary bronze)?

A. J.

Answer: Free sodium cyanide in a solution containing both zinc and free caustic is only an approximation. We would suggest that you titrate a 5 cc. sample of solution, after adding 100 cc. of water and 1 cc. of 30% potassium iodide, with 0.1 N. silver nitrate and use this as an empirical figure for the free cyanide content. If the analysis is performed on a newly prepared plating solution, it will give you a standard or desired cyanide content for maintenance purposes. Procedures for caustic and zinc will be found in the METAL FINISHING GUIDEBOOK.

Copper-Silver Alloy Baths

Question: Have you reference articles on copper and silver alloy plating?

H. H. S.

Answer: We can find no references on copper-silver alloys, but deposits of copper-silver-platinum alloys have been reported in the literature from bromide and from iodide baths, with copper contents of 4-24%. The reference is: A. K. Graham, S. Heiman & H. L. Pinkerton, Plating, 36, pp. 148-53 (1949).

Stripping Silver from Steel

Question: In using a strip of sodium cyanide and caustic soda for removing silver from steel which has been copper plated first, we notice that when the solution is about 6 weeks old we start to get pitting of the base metal, before all the silver and copper are stripped. The steel shows a scum of rust and a black film. Is this caused by the copper getting into the strip? Since the parts are costly, we are changing the strip every 3 weeks.

A. W. M.

Answer: If the steel is of the alloy type, it may be pitted by the caustic soda or as a result of drag-in of chloride from a hard water supply. In this case, use of deionized or distilled water together with sodium cyanide but eliminating the caustic is advised.

A high stripping voltage will also result in oxidation of the steel. Keep the voltage below about 2.5 or the point where oxygen is evolved at the anode.

Brick Wheel Dresser

Question: We are sending you under separate cover a brick which one of our customers is using for a wheel dresser. We believe it is made from some sort of a poured pumice, and would appreciate your advising us as to where we can secure these for sale.

S. B.

Answer: The sample brick does not appear to be any form of poured pu-

mice but an ordinary fired, poured clay brick. Actually, any common building brick, either poured or extruded, will serve the same purpose and would be obtainable at the nearest building supply yard.

Satin Chromium Finish

Question: I have been experiencing trouble in obtaining a dull satin chromium finish on our parts, which are finished with a 180 emery wheel, then cleaned and plated for 20 minutes in a bright nickel. They come out of the nickel tank very bright and are dull brushed before chromium plating. The finish is fairly satiny but brighter than parts done by an outside supplier and the two parts must match.

Is there any way of controlling the brightness of the nickel tank to get the dull effect and is satin chromium a standard finish or just one jobber's pet finish? We have also tried dull brushing after chromium plating, which helped a little.

R. H. B.

Answer: There is no way to control the brightness of bright nickel baths in order to produce a dull satin chromium finish. The deposit will generally be too bright under any conditions of operation. It will be necessary to use a dull nickel as an undercoat for the chromium in your case.

Satin chromium is a standard finish but is produced in different degrees of dullness.

Steel Drum for Silver Plating

Question: Kindly send us information on whether it is permissible to use fifty gallon steel drums unlined for silver plating.

W. T. B.

Answer: A steel drum will be suitable for silver solution, but the silver tends to deposit on the sides of the drum. It would be better to get either a polyethylene or other type of lined drum or a liner to fit into the drum.

Adhesion of Hard Chromium

Question: I have been asked about a problem that has not come within my experience but seems within yours and you may possibly help me with it. A wool-textile man has been having the pig-tails (yarn and thread guides) chrome plated, but has been plagued with low service life of the plate, the chrome either lifting, cracking, chipping or otherwise suffering to the extent where the yarns running through are frayed and cut.

I do not do any chrome plating, but have wondered whether any other deposit is suitable and can overcome this trouble.

G. E. M.

Answer: Lifting, cracking or chipping of the chromium plate on the textile pig-tails would indicate improper chromium plating procedures. The deposit, if properly applied, should exhibit none of these effects, only the expected wear during use.

Procedures for preparing various metals for hard chromium plating will be found in the METAL FINISHING GUIDEBOOK.

Coloring Aluminum Castings

Question: I have been trying for several days to color aluminum castings by the immersion system using the formulas given on page 426 of the METAL FINISHING GUIDEBOOK. So far I have been able to produce only a very dull bronze after approximately 45 minutes immersion. I feel that perhaps some pre-treatment of the casting is necessary before coloring can be effected by this method, and would appreciate more information about it.

A. L. B.

Answer: Aluminum castings have an appreciable silicon content which should be removed from the surface before coloring. An acid dip containing hydrofluoric acid will be necessary to remove the silicon skin.

AUGUST 1954

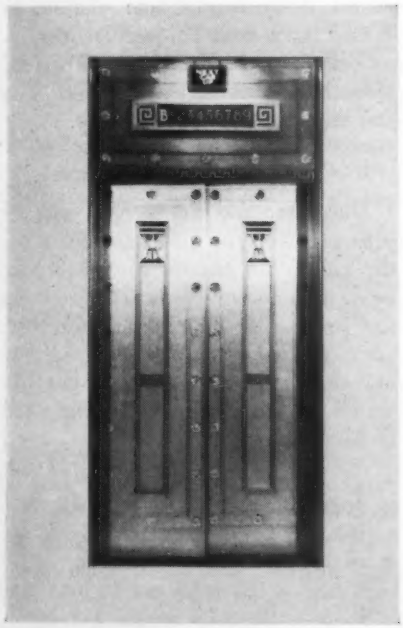
LEA SATIN FINISH—"The Finish of Quality"

- Satin Finished Articles have that quality look and retain this appearance for a long time because the finish is not easily marred.
- The economy of the Satin effect is well known. The Satin Finish blends with and eliminates the effect of underlying metal imperfections. As a result one or more finishing operations become unnecessary, thereby cutting production costs.
- Satin Finished products are finding more and more consumer acceptance everyday

Here are some case histories showing how the Lea Method of Satin Finishing has helped cut production costs.

ALUMINUM

Material — Aluminum.
Article — Furniture trim.
Method of Forming — Punching and stamping.
Final Finish — Satin.



Lea Method:
1. 120 set-up wheel.
2. Lea Compound Grade "L" or "C" on 10" diameter loose muslin buff at 1500 r.p.m.
3. Anodize.

Remarks —
Previously this work had been done by the use of Tripoli buffing after the polishing wheel operation, resulting in some polishing marks remaining. This step involved excessive cleaning which was entirely eliminated by the Lea Method.

BRASS

Material — Brass.
Article — Heavy Door Pulls.
Method of Forming — Casting & machining.
Final Finish — Satin finish.
Lea Method:
1. 100 set-up wheel (canvas).
2. 120 set-up wheel (felt).
3. Grade "B" Lea Compound on a 10" diameter muslin buff with radial sewing at 1800 r.p.m.
4. Lacquering.

Remarks —
The Lea Compound step was done in the same direction as the last polishing wheel operation so that there was no crossing of lines. The finish desired was produced with a minimum number of wheel operations and all cleaning eliminated.

STEEL

Material — Steel.
Article — Escutcheon plates, door plates, etc.
Method of Forming — Stamped.
Final Finish — Special satin brass plate.
Lea Method:
1. Brass plate.
2. Lea Compound Grade "R" on a 10" loose buff at 1500 r.p.m.
3. Lacquering.

Remarks —
In substituting for wet scratch brushing, the Lea Method eliminates all cleaning and drying and the nuisance of water stains on the brass surface.

SILVER

Material — Silverplate.
Article — Tableware.
Method of Forming—Forging (nickel silver).
Final Finish — Butler Finish.*
Lea Method:
1. Silver plate.
2. Lea Compound Grade "FG," "MF," or "MH" on 6" brass wire wheel at 800 r.p.m.

Remarks —
Fine grades of Lea Compound on a brass wire wheel produced the bright line finish required without the aid of a prior color buffing operation common to the old wet scratch brushing procedure.

*Butler Finish — A fine delicate satin finish with some brilliance.

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.
Lea-Michigan, Inc.
14066 Stansbury Ave., Detroit 27, Mich.
Lea Mfg. Company of Canada, Ltd.
370 Victoria St., Toronto 2, Canada
Lea-Ronal, Inc.
Main Office and Laboratory
42-48 27th Street, Long Island City 1, N. Y.
Manufacturing Plant
237 East Aurora Street, Waterbury 20, Conn.

Imitation Gold Finish

Questions One of our customers who is manufacturing toys tells us that there is a new finish on the market which he would like to have applied on the trim of his products. He described it as a "Gold Bond over Zinc Plating" and his source claims that it is a very bright finish which will not mar easily and will take abuse such as scratches and nicks without showing such damage. It is also claimed that the finish is as smooth and as lustrous as any part that had been polished, brass plated and lacquered and will be gold yellow in color.

Do you know of such a finish? If so, will you please advise if it is a patented process, a vacuum process or some new development in the plating or finishing field.

A. B. B.

Answer: If we were furnished with a sample of the finish mentioned, the process employed could probably be readily determined. The vacuum metallizing process would be a possibility but there would be no need to zinc plate in this case.

A fairly good gold finish could be obtained by bright zinc plating, followed by a gold colored lacquer but, unless the base metal were perfectly smooth, the finish would not be an imitation of a polished finish.

Engine Carbon Removal

Question: We would like your recommendation for a formula for a cold dip solvent to remove carbon deposits from automotive valves. This is during the process of rebuilding automotive engines. In our engine plant we have approximately 120 valves per day which are now cleaned by wire brush buffing.

J. M. C.

Answer: Navy Aeronautical Specification C-866 (June 24, 1942) requires a mixture of the following:

Water — 8.5% by weight maximum
Soap — 25% by weight maximum
Cresol or cresylic acid mixtures — 67% by weight maximum

This mixture is used in the ratio of 1 part by volume to 4 parts water at 135-145 deg. F. and is typical of the cresylic formulations.

We would suggest that, rather than go to the trouble of preparing the above mixture, a proprietary compound could be purchased from most manufacturers of cleaners and detergents. These compounds will probably

do a better job since they contain solvents and detergents specially adapted for the purpose.

ABSTRACTS

Baths for Thick Gold Deposits

Metalloberflaeche; vol. 5, No. 5, pp. B79.

While with usual gold plating practice, deposits only of 0.1 to a few microns are applied for decorative purposes, in many other applications coating thicknesses of 25 microns or more become necessary. For these heavy coatings the normal gold baths are not suitable since their low gold contents only permit of low current densities. For heavy gold plating, baths compositions have been developed which approximate other plating baths in their metal contents. For example Pfanhauser has recommended a bath which has the following composition per liter: 30 g. gold as gold chloride and 100 g. potassium cyanide. It is recommended however to work this bath at only 0.1 amp./sq.dm. and 10 hours are needed to obtain a deposit of 0.03 mm. (about 0.0015"). A gold plating bath has been developed by Paweck and Weiner that contains 5 to 20 g./l. of gold and 30 g./l. of potassium ferrocyanide up to the limit of solubility. It is stated that with this bath current densities of 4 to 10 amp./sq.dm. are permissible but this bath does not appear to have come into extended use. Some use has been made of the acid baths as used in gold refining practice. Such a bath composition is: 25-40 g./l. gold; 20-50 cc../l. hydrochloric acid; 10-30 g./l. sodium chloride and 10-20 g./l. sulfuric acid. The bath is intended to plate heavy gold deposits or to strengthen the gilding first obtained from a normal cyanide bath. The bath works at 70° C. and with current densities of 8-10 amp./ sq.dm. The strongly acid nature of this bath will present difficulties in many cases.

Coloration of Zinc Die Castings

Reininger: *Metalloberflaeche.* Vol. 5, No. 5. p. B76-B77.

Zinc die castings have come into extensive use within recent years and standardization classifies them into 3 main groups: For chill and sand cast ware there is used the alloy with 4% aluminum, about 1% copper and 0.02 to 0.05% magnesium.

For coloration of the zinc die cast-

FREE!

Calculator Solves Everyday Metal Cleaner Problems

INDICATES:

Tank Capacity in Gallons
Pounds of Cleaner per Charge
Pounds of Daily Make-Up Charge
Most Efficient Cleaner

• Pennsalt has developed a simple slide chart to do the usual everyday calculations for you. Reads in useful terms of gallons and pounds. Even suggests the most effective cleaner for a particular metal and cleaning process.

The Pennsalt Metal Cleaning Guide covers soak, spray, electrolytic and barrel-type processes. Takes only seconds to use, yet saves up to a half-hour of your time every day.

Get your free Metal Cleaning Guide by calling your local Pennsalt Metal Cleaning Specialist. Or write, on your letterhead, to: Metal Processing Dept., Pennsylvania Salt Mfg. Co., *EAST:* 825 Widener Bldg., Philadelphia 7, Pa. *WEST:* 2168 Shattuck Ave., Berkeley 4, Calif.

Pennsalt Chemicals

ings, the ware to be treated must first be freed from its casting skin and this is achieved by immersion in a boiling pickling bath of 40 g. trisodium phosphate per liter of water for 5 minutes. The coloring process then follows.

For obtaining a black color on the zinc surface, the bath composition is: 25 g. ammonium chloride plus 38 g. crystalline nickel chloride with 13 g. ammonium sulfocyanide and 3 g. zinc chloride per liter of water. The bath is worked at room temperature and the ware is immersed for 1 hour. A very pure black color is obtained by rapid treatment, rinsing and dipping in a 1% sodium sulfate solution with again rinsing.

A dark brown color is obtained by immersion in a bath containing: 200 g. crystalline copper nitrate per liter of water. The bath is worked at room temperature and the immersion time is 10 seconds.

A steel gray color is obtained by the following bath: 60 g. crystal cobalt chloride with 60 g. ammonium chloride per liter of water. The bath is worked at room temperature, and immersion time is 10 minutes.

Varigated copper colors are obtained with the following bath: 100 g. crystal copper sulfate with 100 g. acid potassium tartrate plus 200 g. caustic soda per liter of water. The bath is worked at 30°C. and the immersion time is 30 seconds to 3 minutes.

A silver gray color is obtained on the zinc with the following bath: 100 g. sodium hyposulfite with 30 g. of concentrated sulfuric acid per liter of water. The bath is worked at 60-70°C. and the immersion time is 2 minutes. With this bath, the sodium hyposulfite should first be dissolved, then the sulfuric acid slowly poured in, the bath allowed to stand off for 12 hours, then decanted and filtered.

With the copper sulfate bath, all the sulfate should first be dissolved and only then should the caustic soda be added. A uniform color can not be obtained with this bath if the treatment time is too long.

The treatment time in the coloring bath will depend, to a certain extent, naturally on the size of the castings being dipped, the intensity of the color desired and finally increasing exhaustion of the bath will influence the time factor. After coloring, the ware is immediately rinsed in flowing cold water or for 1 minute in boiling water. The following post-treatment has been found effective. After drying the colored casting it is covered with a thin coating of colorless cellulose lacquer. This protective lacquer film has been found particularly useful for the dark brown color which is sensitive to handling and moisture.

Plating Palladium

H. L. Grube: *Metalloberflaeche*. Vol. 5, No. 4, p. B62.

Palladium plating baths are of analagous composition to the platinum plating baths. For the phosphate bath, a solution of 100 g. disodium phosphate and 20 g. diammonium phosphate are dissolved in a sufficient amount of water and heated to about 70°C. To this is added a hot aqueous solution of 10 g. palladium chloride (60% Pd.) and 60 g. ammonium chloride. These two salts must be dissolved together as palladium chloride will not dissolve alone in water. To the mixture of the chlorides and phosphates there is then added 30 cc. of ammonia before the solution is made up to 1 liter.

Plating should be conducted at 70° to 80°C. With a current density of 0.3 amp./sq. dm., even at room temperature the bath is able to deposit brilliant, adherent deposits. The plating time should be limited to 5-15 minutes. Heavier deposits begin to become gray and need scratch brushing. With bulk plating in drums and barrel plating units, with this bath and also with the following one, heavy deposits can be achieved in one working cycle.

The palladium plating bath has also given good results in practice. It contains:

9 g. dinitrodiaminopalladium (45.7% Pd.)
25 g. sodium chloride.
8 g. sodium nitrite.
50 cc. ammonia.
1 liter water.

The dinitrodiaminopalladium which is prepared like the corresponding platinum salt is unfortunately more highly water soluble than the latter so that the yield during preparation is unsatisfactory. The bath gives satisfactory deposits and can be maintained in use for a relatively long period by repeated re-saturation.

A weakly acid bath has been reported by Erdmann which works with soluble palladium anodes. Sodium pal-

ladium chloride is used as the palladium salt with additions of sodium nitrite, sodium chloride and boric acid. Tests are still proceeding with this bath; in some quarters it has been found that. as opposed to the phosphate and diaminonitrite baths there is a completely unsatisfactory adhesion of the deposited palladium on nickel. In addition, the deposits were brilliant but darker than palladium plated from the above two baths but current densities of 4-10 amp./sq. dm. can be used.

Bright Gold Plating Baths

B. Wullhorst: *Metalloberflaeche.* Vol. 7, No. 4. p. A58.

It is desirable in gold plating practice to obtain brilliant gold deposits direct from the bath to avoid the high polishing losses. Because of the relatively high price of gold this has greater significance than in the case of the other metals. Up to now, however, no commercially usable bright gold plating bath has been placed on the market which serves to show that the difficulties to be overcome are far from simple. In the case of hard gold coatings, which would be primarily concerned in questions of bright gold plating baths, it is difficult to obtain coatings of greater thickness and satisfactory characteristics and the employment of brightening additions serves still further to influence the properties of the deposit unfavorably. Many sulfur compounds and colloidal substances which have been developed for use in other plating baths, fail completely in gold baths. In addition, the deposits become brittle even still more than they do in the normal baths.

For this reason development work has been in the direction of completely avoiding the use of brightening additions in the bath by variation of the bath composition and working conditions. An example of a gold bath which deviates from the normal cyanide electrolytes and whose pH value of around 7 is produced by monopotassium phosphate is the Exudor process of the German Elektrizitaets Gesellschaft Pforzheim. The gold coatings obtained with these baths, and preferably red gold, are deposited in an almost brilliant form and, because of their smooth surface, can easily be polished to a high brilliance. Apart from the fact that maintaining constant pH by continuous addition of phosphoric acid or its acid salts is required, which easily leads to the generation of cyanide gas, these red gold deposits are just as sensitive to surface discoloration as other red gold deposits. Recent research has been in the direction of depositing gold coatings from baths which are treated with supersonic vibrations to obtain the gold coating in a bright form. At the moment promising results have been obtained with this method but it is not known as to what thickness these coatings can be produced without suffering loss of brilliance. This new method of bright gold plating, which may be regarded as in its infancy at the moment, has not received much notice on account of the small practical experience which has as yet been obtained and insufficient details which have been made known regarding the operating details.

Rhodium Plating

H. L. Grube: *Metalloberflaeche.* Vol. 5, No. 4, p. B62.

Only the acid sulfate and the phosphate baths have attained practical importance with the rhodium plating baths. The sulfate bath which is in general use in Germany contains 2.5 g. l. of rhodium as sulfate dissolved in relatively strong sulfuric acid. (up to 30 g./l.). Small additions of organic oxy-acids, potassium or ammonium sulfate and also uranium salts serve to brighten the color of the deposit still further but, with correct handling

of the rhodium bath, these are not really necessary. The baths are prepared with a concentrate of 20 g./l. rhodium, as the preparation of a solid soluble rhodium sulfate with definite rhodium content is not practicable.

The phosphate baths contain 2 g./l. rhodium and 20 cc./l. of concentrated phosphoric acid (85% H_3PO_4). Mixed baths have also been used in which a small amount of phosphoric acid is added to the sulfate. The baths are operated at room temperature at a current density of 0.3 to 0.5 amp./sq. dm. and 2-4 volts. The plating time is 5 to 15 minutes and, for art ware, is seldom more than 5 minutes.

If plating is continued for more than 15 minutes, the deposit assumes a milky shade and, because of the hardness, cannot be polished up again. With individually racked parts a deposit of a maximum of 0.5 microns only can be applied. It has been claimed that additions of small amounts of phenol or sugar of lead also permit obtaining brilliant deposits with more than 1 micron coating thickness.

Pretreatment Techniques for Dip Copper Coating of Iron and Steel

B. M. Pearson: *Beiztechnik*. Vol. 2, No. 12, pp. 181-182.

An essential requirement to obtain a satisfactory coppering is a careful cleaning, derusting and descaling of the metal before dipping. Recommended are alkaline dip and spray degreasing agents which, in the time given to this pretreatment stage, will produce a wettable, clean and grease-free surface on the steel part. After degreasing and cleaning, the parts are rinsed with hot water. If in the previous pre-drawing stages the wire rod has been treated with lime, the pickling bath also removes the lime soap residues easily and completely. Provision must be made for moving the ware in the bath, particularly if wire coils are being treated. After pickling, the ware is rinsed in hot water and immediately passed to the copper dipping bath. The treatment of ordinary steels is quite straightforward. More care is required for the treatment of stainless and acid resistant steels. These special steels must first be depassivated in a special bath. It is necessary here to differentiate between the austenitic and ferritic steels. For the steels of the austenitic type i.e. 18 p.c. chromium and 8 p.c. nickel the de-passivation bath is prepared by adding to 100 liters of water 10 liters of concentrated sulfuric acid and 3 to 5 liters of concentrated hydrochloric acid. The de-passivation bath is heated to 80°C. and the ware remains in the pickle for 3 to 5 minutes and is then immediately passed to the copper dip bath without an intermediate rinse. If the ferritic steels are to be coppered, they are degreased, cleaned, rinsed and passed into a de-passivation bath which contains 20 to 30 liters of concentrated hydrochloric acid per 100 liters of water at a temperature of 50° to 55°C. Treatment time in this bath is 2 to 5 minutes. After this the steel parts are rapidly and thoroughly rinsed with cold water and immediately passed to the copper dip bath.

Tinning Aluminum with the Aid of Supersonic Vibration

P. Wenk and H. Boljahn: *Zeit. Metallkunde*. Vol. 43, pp. 322-324.

The authors describe the mode of operation of an equipment for the tinning of aluminum with the aid of supersonic vibrations and details are given regarding the application of the equipment to soldering of aluminum, regarding the influence of the effective duration of the supersonics on the bonding of aluminum and and tin as well as on the corrosion behaviour of the soldered joints.

Sealing Technique of Anodized Aluminum to Increase Corrosion Resistance

A. E. Durkin: *Aluminium*. Vol. 28, No. 1/2, p. 18.

The author has established that the sealing of the anodized aluminum coating with pure water (pH value around 6) gives a 35% higher corrosion resistance than when the sealing operation is conducted with normal tap water.

Anodizing of Aluminum and Aluminum Alloys

Maschine und Werkzeug. Vol. 53, No. 16, pp. 4-5.

Details are given regarding the application possibilities of the Eloxal anodizing process and information is given regarding material requirements for the operation of the process and the properties of the films obtained. The field of application of the process covers a wide range. The anodizing of light metal pistons for internal combustion engines by this process reduces wear and carbonization troubles in the engine and improves the cold starting characteristics as a result of the good oil absorption properties of the anodized piston surface. The maintenance and cleaning of anodized constructional and architectural parts which are exposed to the atmosphere and to weathering influences will obviously be lightened.

Investigation of Methods for the Evaluation of the Electrical Properties of the Oxide Coatings Obtained by Anodizing Aluminum

W. Ruff: *Aluminium*. Vol. 28, No. 5, p. 13.

According to the author, the present methods available for evaluation purposes suffer from considerable deviation in the measurement values obtained. It is shown that the responsibility for this can be ascribed to spark formation with the test current flow. It is more favorable to work with a current limitation of 100 microamps with the use of a load head with two tandem coupled electrodes each of 6.3 mm. diameter and per 100 g. of loading pressure. The breakdown voltage at first rises rapidly, then fluctuates and is again finally more rapid.

PATENTS

Treating Plated Magnesium

U. S. Patent 2,661,329. *Dec.* 1, 1953. *H. K. De Long, assignor to The Dow Chemical Co.*

In a method of treating a casting of a metal selected from the group consisting of magnesium and the magnesium base alloys, said casting having an electroplated metallic coating thereon, so as to prevent blistering of the coating when the temperature of the casting is raised above about 450° F., the step which consists in subjecting the electroplated casting to a heating for 4 to 16 hours at a temperature between 250° F. and 450° F.

Treating Pickling Wastes

U. S. Patent 2,662,812. *Dec.* 15, 1953. *J. A. Shaw, assignor to Koppers Co., Incorporated*

The method of separating into ferrous sulphate and sulfuric acid, pickle liquor that has been produced by treating ferrous metal with sulphuric acid, said method comprising in combination the steps of evaporating said pickle liquor until the same is saturated with respect to said ferrous sulphate but without any substantial crystallization of ferrous sulphate therefrom, thereafter adding sufficient concentrated sulphuric acid to said evaporated liquor to precipitate the iron in the solution as ferrous sulphate monohydrate and finally separating the so-precipitated monohydrate from said acid liquor.

Bright Dipping Stainless Steel

U. S. Patent 2,662,814. *Dec.* 15, 1953. *J. R. Swihart, assignor to The Diversey Corporation*

A bath for the chemical polishing of stainless steel surfaces and the removal of scale therefrom, consisting essentially of an aqueous solution having a total acid concentration between 20 and 35% by weight and including nitric acid, hydrochloric acid, and between about 15 to 25% by weight of the total solution of an acid of the class consisting of phosphoric acid, sulfuric acid, and a mixture of phosphoric and sulfuric acids, at least 2% of the total solution being nitric acid and at least 2% being hydrochloric acid, with the combined weight of the nitric and

hydrochloric acids being not more than the total weight of said class.

Immersion Copper on Aluminum

U. S. Patent 2,662,831. *Dec.* 15, 1953. *C. R. Culverhouse, Jr., assignor to Anderson Brass Works*

The method of firmly bonding a coating of copper directly to aluminum or aluminum alloys comprising degreasing and cleaning the aluminum to be coated, immersing the aluminum thus degreased and cleaned in an aqueous solution of an alkali zincate, thereby depositing zinc on the aluminum, and chemically replacing the zinc with copper by immersing the zinc-coated aluminum in an aqueous acid solution of copper fluoborate.

Painting Solder

U. S. Patent 2,662,838. *Dec.* 15, 1953. *G. E. Oven and W. Suter, assignors to Kaiser-Frazer Corp.*

A composition for treating solder metal surfaces that have been prepared for such treatment by application thereto of an alcohol solution of phosphoric acid consisting of about 69% by weight of metallic zinc dust, about 13% by weight of pigment zinc chromate, and about 18% of an isopropyl alcohol.

An article including a solder-metal area having surface pits or cavities filled with a reaction product which results when an alcohol solution of phosphoric acid is first reacted with a solder metal and the ensuing product is reacted with a paste of about 84% metallic zinc dust and about [illegible] pigment zinc chromate, said fillings being bonded to the wall surfaces of said pits by reaction of the phosphoric acid portion of said reaction product with the solder metal forming the wall of the cavity.

Solvent Vapor Degreaser

U. S. Patent 2,662,851. *Dec.* 15, 1953. *H. H. Jones and R. C. White, assignors to Harry H. Jones and Robert C. White*

Apparatus for treating work with a volatile solvent, comprising a chamber adapted to contain a solvent vapor and open at the top, a spiral conveyor extending into the chamber through the open top of the latter to a position below the vapor level in the chamber and having a vertical support, a work carrying ramp mounted on the support and extending helically around the support from a position below the vapor level to a position above the chamber, means for depositing work on the ramp below the vapor level, means on the support above the open top of the chamber for moving the ramp vertically with a vibrating motion, and means also on the vertical support above the open top of the chamber for oscillating the ramp about its vertical axis during vibration of said ramp to advance the articles along the ramp.

Loose Abrasive Polishing

U. S. Patent 2,663,980. *Dec.* 29, 1953. *J. F. Harper*

The method of polishing a surface of an article which comprises throwing abrasive particles having minute weight at the surface of the article at a velocity at which the individual particles would tend to be deflected by and to bounce from said surface and simultaneously throwing admixed flexible planate sheet members which have many times greater weight and have a high top surface area to side surface area ratio and which cling to and slide over said surface while pressing said particles against the surface.

Bright Nickel

U. S. Patent 2,662,853. *Dec.* 15, 1953. *D. G. Ellis, assignor to The Harshaw Chemical Co.*

A method for electrodepositing nickel in the form of a deposit which is bright as taken from the plating solution without further treatment and which comprises electrolyzing an aqueous, acid solution of a nickel electrolyte of the class consisting of nickel sulfate, nickel

chloride, and mixtures of nickel sulfate with nickel chloride, said solution also containing cooperating addition agents capable of imparting brightness to the deposit, one of said addition agents being a polyalkylene amine of the class consisting of unsubstituted amines of the general form

$H_2N[(CH_2)_mNH]_n(CH_2)_mNH_2$

where m is an integer from 2 to 4 inclusive and n is an integer greater than 2, and polyalkylene amines which are the condensation products produced by reacting a polyalkylene amine of said general form with a material of the class consisting of epichlorhydrin, acrylonitrile, methyl sulfate, chloracetic acid, epichlorhydrin with phenol, dimethyl chloracetal, benzene sulfonyl chloride, and styrene oxide, soluble in said solution to the extent of at least 0.0001 gram per liter, and having a molecular weight from 100 to 1800, and the other of said addition agents being an organic compound of the class consisting of benzene mono-sulfonic acid, benzene disulfonic acids, monochlor benzene monosulfonic acids, benzene monosulfonamide, saccharine, dichloro benzene disulfonic acids, 2,5-dibromo benzene sulfonic acid, toluene sulfonic acids, benzaldehyde sulfonic acids, diphenyl sulfonic acids, benzene sulfonyl chloride, para chloro benzene sulfonamide, xylene sulfonamides, para toluene sulfonamide, thiophene sulfonic acids, diphenyl sulfone, naphthalene-1,5-disulphonic acid, sulfonated naphthalene, alpha naphthalene monosulfonic acid, beta naphthalene monosulfonic acid, o-toluene sulfonamide chloro naphthalene disulfonates and the sodium, potassium, nickel, and cobalt salts thereof, said first mentioned addition agent being present in concentration from 0.0001 to 0.1 gram per liter, and said second mentioned addition agent being present in concentration from 0.2 to 15 grams per liter.

Pickling Bath Agent

U. S. Patent 2,662,857. *Dec.* 15, 1953. *J. W. Carroll, assignor to The Pennsylvania Salt Mfg. Co.*

A method of reducing the delay in foam formation upon addition of a foaming agent to a non-oxidizing mineral acid pickling bath that contains at least .003% of a foam-delaying organic colloid selected from the group consisting of gelatin, starch and gluten, based on the weight of the bath, that comprises incorporating in the bath at least .00025%, based on the weight of the pickling bath, of a cationic wetting agent containing, in the cation, from one to four basic nitrogen atoms, from one to two aliphatic groups containing from 10 to 18 carbon atoms, and from one to four hydroxy-ethyl groups, said agent being at least water-dispersible at a concentration in water of 0.1% by weight.

Copper Plating Mirrors

U. S. Patent 2,664,363. *Dec.* 29, 1953. *M. Meth*

The method of producing a copper plated silvered mirror including the steps of mounting a transparent plate on a supporting rack, chemically depositing a silver reflective coating from a silver depositing solution on said plate while in its mounted position, and then while the silver reflecting surface is still wet and the plate in place on the rack simultaneously intermingling and spraying onto said surface a copper sulfate solution and a substantially homogeneous fluid suspension of finely divided zinc dust to thereby deposit a copper protective layer.

Buff

U. S. Patent 2,663,125. *Dec.* 22, 1953. *W. Ruthven, assignor to Ajax Buff Co.*

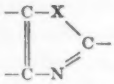
A buffing wheel comprising an annular cloth buff, a clamping member, means carried by said clamping member for securing said member to said buff, and a pair of air deflecting vanes formed integrally with said clamping

member and projecting one from each side thereof, each of said vanes having a first edge extending substantially along a single radius of said clamping member, said vanes being joined to the clamping member along lines of deflection which meet equiangularly at said radius line and diverge outwardly therefrom toward the periphery of said one clamping member whereby during rotation of said buff in either direction the air will be deflected from a tangential path by one of said vanes into a radially outwardly path to cool the buff.

Bright Acid Copper

U. S. Patent 2,663,684. *Dec.* 22, 1953. *W. J. Pierce, assignor to Houdaille-Hershey Corp.*

An electrolyte for electrodepositing copper consisting essentially of an aqueous acid solution of copper sulfate and free sulfuric acid and having dissolved therein, as a brightener for the electro-deposited copper, a heterocyclic compound having the following heterocyclic ring structural arrangement.



wherein X is an atom of group VI of the periodic system selected from the group consisting of oxygen and sulfur. said compound having a concentration in said solution within the range of 0.005-1 gram per liter.

Filter

U. S. Patent 2,664,203. *Dec.* 29, 1953. *V. S. Crane and P. R.Honan, assignors to Delpark Corp.*

A liquid filter including a tank for receiving filtered liquid, a roll of expendable filter media mounted at one side of said tank, a winding reel for said media mounted at the opposite side thereof, an endless perforated conveyor supporting said media, driving rolls at each end of said tank for mounting and driving said conveyor, a lifting element on said tank over which opposite sides of said conveyor ride for causing it to sag therein to form a pocket, mechanism for periodically rotating said rolls at the same speed of rotation to move said conveyor and maintain the sag therein, a slip clutch operably connecting said mechanism and reel for normally driving said reel at the same speed of rotation as said rolls while permitting slippage thereof to compensate for increase in diameter of the rolled media

for jointly moving said media and conveyor to present a fresh section thereof over said tank, and a control member in said pocket connected with said mechanism for periodically rendering said driving mechanism operative depending upon the accumulation of unfiltered liquid in said pocket.

Bright Nickel

U. S. Patent 2,664,392. *Dec.* 29, 1953. *N. F. Blackburn, assignor to The Pennsylvania Salt Mfg. Co.*

A method for electro-depositing bright ductile deposits of nickel which comprises electrolyzing an aqueous solution of nickel fluoborate having small quantities of sulfurized quinoidine and benzoic sulfimide therein sufficient to produce bright nickel deposits from said solution.

SURFACE TREATMENT

(*Continued from page* 82)

centrated acid. The time of immersion is also variable depending on the alloy, pure aluminum requiring longer times than alloys, particularly those containing comparatively large amounts of copper.

In brightening silicon or manganese alloys, the work may be given an immersion in a solution containing 75% nitric acid and 25% hydrofluoric acid. This operation requires only a few seconds and is carried out at room temperature, producing a fine smooth diffuse surface finish. In dilute concentrations and at elevated temperature, the same dip may also be used to brighten pure aluminum surfaces.[15]

OTHER ACID TREATMENTS:

For the purpose of removing thick oxide films or faulty anodic or chemical oxide coatings, articles may be treated in a solution containing:

Sulphuric acid	10%
Hydrofluoric acid	4"

for a period just long enough to remove the film without etching the metal. Nitric-hydrofluoric acid and sulphuric-phosphoric acid mixtures may also be employed for this purpose. Care must be taken not to prolong the immersion period in these treatments. By careful control of the operating time the metal will, in most cases, be ready for coating without re-buffing. Nitric-hydrofluoric acid mixtures are also employed in stripping phenolic and black-japan coatings, etc.

(*To be continued next month*)

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Automatic Selenium Rectifier

Richardson-Allen Corp., Dept. MF, 116-15 Fifteenth Ave., College Point, N. Y.

A new automatic selenium rectifier for heavy-duty production testing is reported to have an adjustable output voltage ranging from 3 to 15 volts, 25 to 120 amperes DC, filtered to 1% r.m.s. ripple, with automatic constant voltage plus or minus 1%. There is also automatic correction of plus or minus 5% for fluctuations of the AC input, which is 220 volts, 3-phase, 60 cycles. The unit is convection-cooled for 35°C. ambient temperature operation and offers the advantage of automatic circuits which are completely magnetic, with no electronic components. It is housed in a cabinet 20″ x 20″ x 46″ high.

Phosphate Coating for Zinc

Pennsylvania Salt Mfg. Co., Dept. MF, 1000 Widener Building, Philadelphia 7, Pa.

Availability of Fosbond 61, a new product for use in producing a phosphate coating on zinc, has been announced by the company.

This phosphatizing compound provides a fine crystaline coating on metal surfaces which serves as an excellent base for subsequent painting operations. Mixed with water, it is applied by spraying.

The material was developed at the company's Whitemarsh research laboratories. It is an addition to the Metal Processing Department's paint-bond- and rust resistant phosphate coatings line. While designed specifically for use on zinc surfaces, the new product may also be used on steel. This permits its use in operations where both steel and zinc are being processed.

Barrel Finishing Compounds

Almco Supersheen, Dept. MF, Albert Lea, Min.

The above manufacturer of deburring and finishing equipment, materials and compounds, has just announced the two newly perfected compounds that are finding wide favor and quick acceptance due to the superiority of their performance.

Filling a long felt need is Compound No. 58. This entirely new product is a coarse, heavy duty long life abrasive grinding compound for heavy deburring and grinding operations. It can be used on all metals, but recommended for ferrous parts. Particularly developed as a non-foaming compound for use in long runs where heavy foam may develop and deter the grinding function.

In addition to Compound No. 58, the firm has also announced their Compound No. 41 — an economical compound for use with all metals, but especially designed for burnishing of brass, zinc, aluminum, and copper.

Brass and Copper Cleaner

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

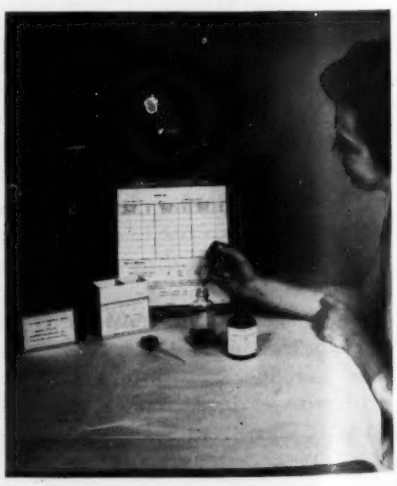
The above manufacturers of specialized cleaning and related materials, have announced the development of Composition No. 191, a material for electrocleaning copper and its alloys prior to plating. The new cleaner is said to possess special ingredients that reduce tarnishing of work in the higher-temperature cleaning ranges, or where long treating cycles or prolonged transfer periods may occur.

The cleaner is a free-flowing, fast-dissolving granular product whose solutions are colorless and have little or no odor. Among the advantages claimed for this material are: (1) it has long solution life; (2) possesses broad current-density range; (3) has wide temperature range, 160° to 210°F.; (4) cleans at low concentrations; (5) removes buffing dirt and other common soils rapidly; (6) has excellent rinsibility in both hot and cold water; (7) keeps tarnishing at a minimum. For ordinary applications of this material, recommended concentrations start at 5 oz. per gallon, rising slightly as the solution ages, to compensate for loss due to drag-out and carbonation of solution from carbon dioxide in the air, it is reported.

Test Kit for Cleaners

Wyandotte Chemicals Corp., Dept. MF, Wyandotte, Mich.

A simple test kit for controlling metal cleaning solutions that can be accurately operated by even untrained personnel has just been released by the above firm's technical service department. By varying the testing solu-



tions, the one basic Wyandotte Teskit shown is adaptable to all industrial products in the line, except emulsion cleaners.

As shown in the photo, each kit contains two bottles. One is equipped with a dropper and contains a label showing the name of the Wyandotte product which it is designed to test. The second bottle contains a pipette-type dropper and has a testing level-mark scored into the glass. The bottles are neatly held in a sturdy, fiber box containing labels which give complete testing instructions.

The company's industrial representatives and the 17 district sales offices stock the testing solutions and the kits. Each kit contains sufficient testing solution for approximately 180 tests. Only a few drops of testing solution are necessary to secure accurate readings, seldom more than 20.

Corrosion-Resistant Heater

Heil Process Equip. Corp., Dept. MF, 12901 Elmwood Ave., Cleveland 11, O.

The new HN Style Nocordal immersion heating unit complements the other popular types of impervious graphite heating and cooling coils and external exchangers produced by the above manufacturer.

This heater is designed specifically for use in services involving nitric acid. A plastic coated steel hanger is included to assure proper location of the heater in the tank. The normal excellent suitability of Nocordal products for muriatic, sulphuric, hydrofluoric and other acid and salt solutions is maintained fully in the HN Style units. The excellent heat transfer properties provide greater heating or cooling per square foot of surface area, than obtained through the use of most metals.

Nickel Sulfamate Plating Process

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

An improved nickel sulfamate plating process is claimed to plate 75% faster, is more versatile, is easier to control and produces harder deposits with less brittleness than other sulfamate processes presently available.

Nickel sulfamate baths are commonly used for applying heavy coatings in electroforming, electrotyping and re-sizing operations. The new bath plates up to 0.007″ of nickel per hour compared to a high of 0.004″ per hour possible with present baths. Operation at current densities of 140 asf. make this high speed possible; conventional baths only go as high as of 80 asf.

With this versatile process, deposits of low internal stress are easily obtained, and a wide range of specific compressive and tensile stresses are also possible. Compressive stresses from zero to -9×10^3 psi. and tensile stresses from zero to 18×10^3 psi. may be had by varying current density, temperature and concentration of the bath's addition agent.

Stress characteristics obtained with these variables have been charted. Users of the process may obtain operating conditions for desired stress by reading them right off the chart.

The bath is made up of nickel sulfamate, nickel chloride, boric acid and an addition agent. Pitting is no problem with this bath, and solutions do not require a wetting agent. Purity of the new bath consequently is higher, and complete analysis of all constituents are possible.

Additional features of the new H-VW-M process include: (1) heavy deposits (up to ½″), (2) air agitation compared to pump agitation for conventional baths, (3) uses any type high purity nickel anode, where conventional baths prefer rolled, depolarized ones. For easy handling, nickel sulfamate is packaged as a dry salt in fiber continers. It is customarily packaged as a solution and shipped in carboys.

Like conventional baths, this bath has high conductivity and excellent anode corrosion. Anode and cathode efficiencies are in close balance, making for stable composition for long periods. The bath is not sensitive to impurities, either organic or metallic. If excessively contaminated it can be

purified with activated carbon and low current density electrolysis.

Heating, filtering and pumping equipment may be made of Karbate, nickel or rubber, and lined with Koroseal or Saran. Stainless steel may be used in spots where the bare metal cannot become anodic.

Rust Preventive Dispenser

E. F. Houghton & Co., Dept. MF, 303 W. Lehigh Ave., Philadelphia 33, Pa.

A new, time-saving method of rust prevention, utilizing 12-ounce pressurized, push-button cans, has been announced.

Containing "Rust Veto Spray," these handy dispensers provide a quick, clean, and effective way to apply an even, transparent protective film to metal parts. It is especially handy for protecting small items such as tools, dies, gauges, precision parts, hardware, and items being stored.

The thin, transparent film protects metal parts for long periods and need not be removed when the item is ready for use.

The product is sold only in cases of twelve at $15.24 per case, F.O.B. Lancaster, Pa.

Barrel Finishing Compounds

Lupoline Automatic Polishing Equip. Corp., Dept. MF, 99 Columbus Ave., Tuckahoe, N. Y.

A special double-action line of tumbling compounds has been developed for surface finishing to a smooth high luster stainless steel, brass, copper, and silver, also to refinish plated parts. Samples and complete data will be submitted to concerns applying on own letterhead.

Aluminum Neoprene Protective Coating

Chemical Coatings and Engineering Co., Dept. MF, The Rucker Bldg., Darby, Pa.

An aluminum Neoprene coating designed for protection of ferrous metals against atmospheric corrosion including salt spray and fumes is being introduced. The new coating, Seaco No. 342, is designed to combine the excellent chemical and weathering resistance of Neoprene with a reflecting, non-fading pigment. It requires no separate activators and is self curing at normal room temperatures.

The applied coating resembles alum-

inum metal in appearance and, if desired, the coating can be tinted to give a wide range of metallic colors. Color stability is excellent.

The product differs from most aluminum pigmented coatings since coating thicknesses of up to 0.002″ per coat can be applied. This permits economic application of effective corrosion resistant films.

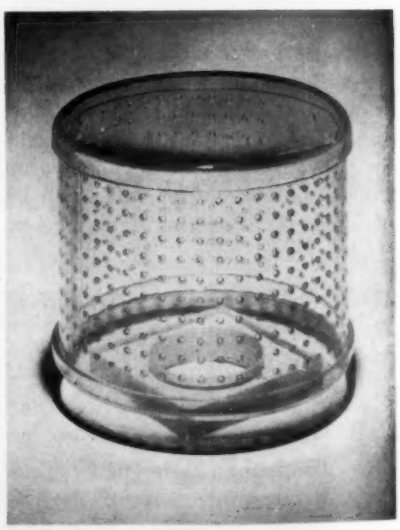
The coating is elastic and has very low moisture or chemical permeability. Exposure tests conducted over the past several years indicate the coatings will have important application on bridges, tanks, and structural steel.

Application is by brush, spray, or roller and coverage is 170 square feet per gal per 0.002″ thickness.

Water Diffusers for Ion-Exchangers

The Permutit Co., Dept. MF, 330 W. 42nd St., New York 36, N. Y.

For efficient operation and to prevent windrowing and shifting of ion exchange resin beds, a suitable method of diffusing the influent water has been perfected. In the company's industrial cation and anion exchanger units 54 inches in diameter and larger, the inlet distribution system has been constructed so that the water to be treated passes through an arrangement of cylindrical inlet diffusers. For the hydrogen cation exchangers and anion exchangers these devices are fabricated from an inert plastic such as methyl methacrylate.



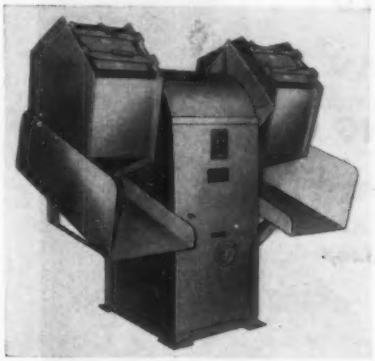
The plastic diffusers, as illustrated, are perforated plastic cylinders about 6 inches in diameter by 5 inches high, tapped and threaded for a standard pipe connector. Water flowing into the diffusers under pressure and passing

outwardly through these perforations is thoroughly diffused.

These diffusers are connected to a central inlet distributor hub and arranged around this hub in such a pattern that the influent passing through them will be evenly dispersed over the entire cation or anion exchanger bed. This dispersion over the bed prevents the bed from shifting and allows for greater exchanger efficiency. For their sodium cation exchangers, since no acid conditions are encountered, the diffusers are made of perforated metal.

Twin Precision Barrel Finisher

Rampe Mfg. Co., Dept. MF, 3320 St. Clair Ave., Cleveland 14, O.



The new Super Twin Precision Barrel Finisher with 4 cu. ft. (2 cu. ft. per barrel) has twice the capacity of the standard Twin Finisher.

Construction features include sealed ball bearings throughout, variable speed drive from 12 to 36 R.P.M., heavy construction throughout, ¾ H.P. 220/440 volt 3-phase motor, water tight push button, magnetic starter. The hexagonal steel burring barrels are constructed from 10 gage steel, welded watertight, and with simple gasketed side covers attached with two screws.

The model illustrated has moveable chutes which can be tilted to the rear to drain off liquid and to the front to discharge load. In rear position, chutes act as very adequate safety guards. Tote boxes can be furnished in place of the moveable chutes, if desired. Barrels can be lined with vinyl plastic, if specified.

Prices range from $735.00 to $995.00 depending upon equipment. Write the manufacturer for complete information.

Industrial Washing Machine

Industrial Washing Machine Corp., Dept. MF, Matawan, N. J.

A new washing machine to process

steel stampings and machine products is designated Drum Cabinet model 30 x 20, and is extremely compact, being only 4′ 6″ long, 4′ wide and 7′ high. It is heated by gas, but can be designed for steam heat. A combination model, the machine has a tumbling mesh drum for small stampings and a rocking cradle that will hold baskets of machined parts. These may be used alternately.

Operation is very simple. The operator places either the drum or baskets containing work to be cleaned in the machine and closes the door. He turns the timer to the desired spray time and the pump starts spraying detergents at high pressure. While the spray is in operation the drum rotates, tumbling the work and exposing all areas to the detergent. When the baskets are used they are rocked back and forth with the same result. After the wash has been completed, a clear spray rinses off the detergent.

Degreasing Solvent

Octagon Process, Inc., Dept. MF, 15 Bank St., Staten Island 1, N. Y.

The above manufacturer has developed a new degreasing solvent, which will remove light oils from metal parts more cheaply than vapor degreasing, it is claimed. It is a low cost method which saves as much as 50% of the cost of vapor degreasing, where trichlorethylene and perchlorethylene are used.

Klearall 95 is used cold, evaporates rapidly from parts and can be redistilled dozens of times. It has no objectionable odor, is non-explosive, does not support combustion and does not contain carbon tetrachloride.

It is used in a mild steel tank for immersion degreasing and has been

particularly successful when cleaning prior to painting is required on such items as, cabinets, steel shelving, metal furniture, lighting fixtures, radio parts, doors, fans, metal awnings etc. It is now being shipped in carload lots to outstanding metal fabricators.

Heat Exchanger

Nukem Products Corp., Dept. MF, Buffalo 20, N. Y.

The above firm announces its Hi-Temp heat exchanger for heat transfer of pickling, plating and chemical solutions. A saving of 15% is claimed in acid consumption over other methods for the heat transfer of corrosive liquids.

Among its advantages are said to be elimination of acid dilution by steam condensation, uniform solution temperatures, curtailed vapor loss and fuming, controlled steam consumption, and maxium heat transfer efficiency.

Additional information may be obtained by writing to the manufacturer at the above address.

Plating Identification Kit

Kocour Company, Dept. MF, 4802 S. St. Louis Ave., Chicago 32, Ill.

The Kocour Identification Set Model PIA is used to positively identify and differentiate between metallic deposits. Tests are provided for identifying cadmium, tin, silver, lead, nickel, chromium, zinc and presence or absence of chromate conversion coatings. The set is complete and includes all of the necessary solutions in stopper and dropper bottles, contact papers and a panel with meter, on-off switch, batteries and leads with probe and clip all enclosed in a wall type wooden cabinet.

The Cadmium Identification Set is also available for those interested in

differentiating between cadmium and zinc only. This economical set is packed in a handy two tray box.

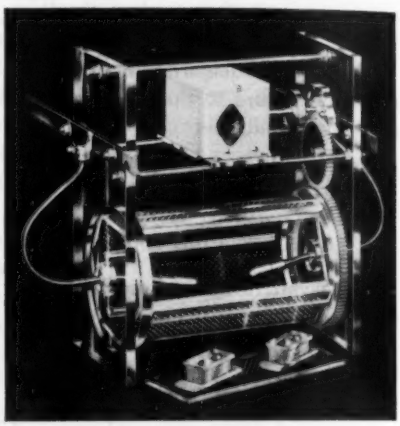
Automatic Polishing Machine

Hammond Machinery Builders, Inc., Dept. MF, 1600 Douglas Ave., Kalamazoo, Mich.

A recent new development covers a larger rotary automatic indexing polishing and buffing machine. Known as the Model K-62-7, it will accommodate up to six head and stand units. The indexing turret is 62″ outside diameter and 42″ high from floor to top of spindles. The machine operates on a constant high speed index movement of one second and has an adjustable dwell period. The machine has an operating range of from 150 to 1700 indexes per hour. The table is locked in each indexed position by a tapered lock bolt that engages the table. The lock bolt is pulled from the table prior to indexing by a cam on the Geneva lever shaft. Table work spindles are driven by a ¾ HP motor and are variable speed of 15 to 45 r.p.m. or 50 to 150 r.p.m. and operate entirely independent of the indexing operation on the machine. The table is equipped with 7 work spindles, 6 of which support and rotate the work at the wheel station and the 7th is at the operator's station in front of the machine for loading and unloading. To assist the operator, the spindle at the operator's station does not revolve, but is stopped and held by a spring tensioned brake. This brake also serves to start rotation of the spindle as it is indexed into the moving table chain, thereby reducing wear to a minimum. The machine complete with six head and stand units weighs approximately 11,500 lbs.

Portable Plating Barrel

Starline Products, Dept. MF, 1717 N. Main St., Los Angeles 12, Cal.



The new plating barrel weighs only 27 lbs, and was designed for small quantities. It is fabricated in acrylic and driven by torque-rated geared motor. The barrel uses standard electric supply. Inside dimensions are 6 x 12 in. with 3/32-in. perforations. Gears and sides are ⅝ in. thick and withstand 180°F. All metal parts exposed to plating solution are made of Monel.

Phosphating Primer

Emjay Maintenance Engineers, Dept. MF, 327 Union Ave., Rutherford, N. J.

A new product used for priming rusted metal surfaces which are impractical to sandblast has been added to the line of protective coatings manufactured by the company. This new material for use on structural steel installations and equipment is called Kip 100.

When applied like ordinary paint directly on rusted areas, the primer converts the oxide film into absorbent.

inert and stable phosphates. Paint is then applied directly over the phosphate coat, which forms an excellent bond. Application of the primer, which is superior to wirebrushing, prolongs paint life many times over and inhibits further rust formation underneath the paint.

Drum & Barrel Truck

Morse Mfg. Co., Inc., Dept. MF, 727 W. Manlius St., E. Syracuse, N. Y.

The new Morse No. 150 barrel truck is perfectly-balanced, and a 1,000 lb. load can be held over the center of gravity by just one finger of the operator's hand. It accommodates containers from 24″ to 45″ long, and any diameter from 15″ up. The truck picks up and deposits loads on pallets up to

8″ high, and due to its 20″ width, will easily move drums from tightly packed rows.

The truck comes complete with solid rubber tired, roller bearing wheels, is built for endurance, and economically priced.

The following specifications apply to this unit:

Overall length	61″
Width at handles	24½″
Width of wheels	20″
Wheels	10″ dia.
Capacity	1,000 lbs.
Weight	60 lbs.

Aluminum Foil Tape

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

A new aluminum foil pressure-sensitive tape for widespread industrial sealing, splicing, electroplating, conduction, and heat reflection jobs was announced this month.

The new tape — "Scotch" brand aluminum foil tape No. 425 — is made with a dead-soft aluminum foil backing coated with a high-tack thermosetting type adhesive. Total thickness is 5.25 mils.

Its average property values include tensile strength of 32 pounds per inch of tape width; elongation of 15% at breaking point; adhesion of 60 ounces per inch of tape width; and a moisture-vapor barrier of 0.1 grams per 100 square inches per 24 hours at 100°F.

Tape No. 425 is unaffected by extreme humidity conditions and features excellent heat reflection, weathering, moisture resistance, and conductivity characteristics. It also meets Government Specification MIL-T-11291 (Ord), dealing with aluminum foil

pressure-sensitive tape for ammunition.

The new tape is being made available in ¼- to 24-inch widths on 60 yard rolls through industrial distributors nationally.

Strippable Protective Coating

Bischoff Chemical Corp., Dept. MF, Ivoryton, Conn.

The first low-cost, transparent strippable coating of the water-white type has just been developed to protect surfaces and edges of metal tools, parts and finished products from corrosion and abrasion during storage, handling and shipping. It is a crystal clear, plastic coating known as Thermo-Cote K.

The material is a butyrate base coating that permits low temperature application at 300°F. In addition, users find it has none of the oil exudation common to thermoplastic coatings. Supplied in convenient small blocks, it is melted in a thermostatically controlled melt tank and brought to the proper dipping temperature.

Metal tools and parts dipped in the melted product are thus protected and packaged in one operation. This strippable coating provides protection against abrasions and corrosion, and forms a shiny transparent, skin-tight covering for products dipped in it. Like other products in this line, it is quickly removable by slitting and peeling, and is usable over and over again.

BUSINESS ITEMS

Atlas Mineral Adds To Line

Atlas Mineral Products Co. announces the addition of natural rubber sheet linings to supplement its neoprene, saran rubber, polyethylene and plasticized polyvinyl chloride sheet and tank linings. In addition to being installed at Mertztown's and Houston's lining shops, these linings are applied in the field by Atlas trained crews.

R. P. Ganchan Appointed ARco Vice-President

R. P. Ganchan

Elected recently to a vice-presidency of *Automotive Rubber Company, Inc.*, was *R. P. (Dick) Ganchan.* In addition to his new office with the parent company, Ganchan is the general manager of *ARco Rubber Processors*, Houston, Tex. He has held this post since 1951. The latter firm is a division of Automotive Rubber.

Ganchan is a native of Beaumont, Tex. He was graduated from Rice Institute in 1940 with an engineering degree. Following service with the Armed Forces during World War II, he served as sales engineer with Standard Brass and Mfg. Co. of Houston.

Graver Announces Appointment of Sales Manager

H. T. Sulcer, vice-president and general manager, *Graver Water Conditioning Co.*, division of Graver Tank & Mfg. Co., Inc., New York, has announced the appointment of *Harold R. Fosnot* as sales manager.

Mr. Fosnot joined the firm upon graduation from Purdue University in 1935 and became a member of its first

training program, which was one of the first of its kind in the industry.

He was previously Chicago district manager, Eastern sales manager and most recently assistant general sales manager.

Mr. Fosnot is a licensed Professional Engineer and graduated from the University of Chicago's Executive Program with a Masters Degree in Business Administration.

Solventol Promotions

Solventol Chemical Products, Inc., announces the promotion of *Julius R. Bellew* to manufacturing manager of

Julius R. Bellew

the Metal Cleaning Equipment Division; and *Ivan Ross* to special engineering consultant for the same division. Both men will have headquarters at the company's home office in Detroit.

Mr. Bellew has been with the company for 10 years, and has had extensive experience in both the engineering and estimating departments. He is an engineering graduate of the University of Detroit, and studied electronics at the Massachusetts Institute of Technology.

Ivan Ross

Mr. Ross joined the firm's engineering staff three years ago, after receiving his engineering degree from Stanford University. In his new position, he will assist the sales organization in an advisory capacity, and will be available for customer engineering field service.

Oakite Assigns New Technical Service Representative

W. Beckhardt is the new technical service representative in the Norris-

W. Beckhardt

town, Pa., area for *Oakite Products, Inc.*, manufacturers of industrial cleaning and metal treating materials.

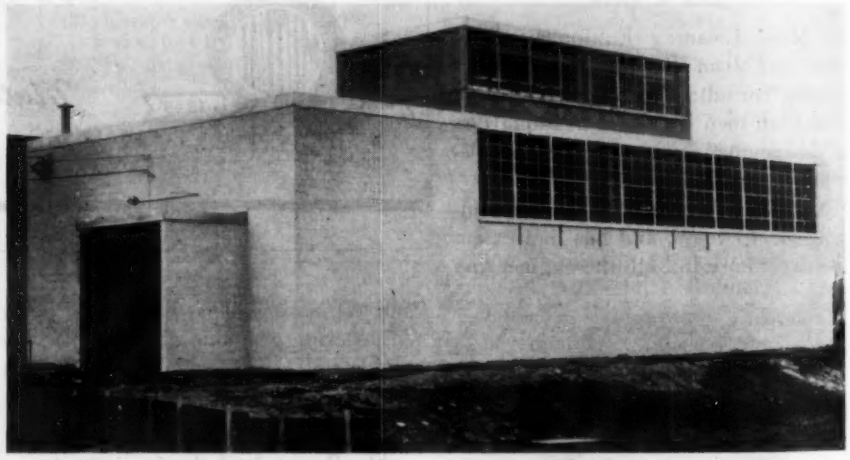
Mr. Beckhardt, who was formerly with the Eastern Tank Maintenance Co. of Philadelphia, completed an intensive eight-week training course at the company's New York headquarters and in the field before taking up his new assignment.

Wagner Brothers Appoints Distributor

John D. Tebben, vice-president, *Wagner Brothers, Inc.*, Detroit manufacturers of electroplating equipment and supplies, announced the recent appointment of the *Reynolds-Robson Supply Co.*, 2213-21 W. Glenwood Ave., Philadelphia 32, Pa., as a distributor for Wagner products.

Reynolds-Robson's sales force will actively promote the sales of these products within a territory comprising Eastern Pennsylvania, Southern New Jersey, Delaware, Maryland, Virginia, District of Columbia, North Carolina, South Carolina, Eastern Georgia and Florida.

Improved Facilities at Roto-Finish



To expedite deliveries and improve manufacturing facilities, the *Roto-Finish Company* announces a new plant addition. The new building is 40 feet by 80 feet and will be devoted entirely to new machinery and equipment for manufacturing grinding chips and compound. It is not intended as a storage building or warehouse. These new manufacturing facilities will improve both the quality of the products and the facilities for handling orders, thus permitting added expediency in deliveries.

Blakeslee Personnel Shift

A shift in sales personnel was made by *G. S. Blakeslee & Co.* in a move to render better and more adequate coverage. *A. L. Bashe* has been made sales manager to replace *Jack Arnold* who is now promoted to chief of the engineering department and new development section.

A. L. Bashe

Mr. Bashe is 38 years old and started working with the company in April of 1943. He was formally a district supervisor covering parts of Michigan, Ohio, Indiana and Kentucky. His personal experience with the usual problems of salesmen and customers plus his vast knowledge of metal degreasing and cleaning applications helps to make him ideally suited to the position of sales manager.

He will work out of the Chicago office but over 80% of his time will be spent in the field working directly with salesman. This will assure customers of even greater service.

Jack Arnold, new head of the engineering department and new development section, is 43 years old and has been working for the company for 14 years. He has proven himself an adept engineer as well as an authority on metal degreasing and cleaning applications.

H-VW-M Expands Equipment Engineering & Installation Activities

Hugh V. McGuire

Plans have been announced here by *Hanson-Van Winkle-Munning Co.*, manufacturer of electroplating and polishing equipment & supplies, for the consolidation and expansion of its engineering & installation sales activities In the future, sales engineering in this field will be handled directly out of the Matawan office and by a staff of specially-trained engineers.

The company concurrently announced the appointment of *Hugh V. McGuire* to head the new group. He will be in charge of all sales engineering relating to engineering & installation activities.

McGuire returns to the firm after a year of intensive experience in the metal finishing equipment field. Previously he was with the company for 13 years. He was a general equipment sales engineer and specialized in metal finishing plant layout.

His background with H-VW-M also includes experience in the export field and with graphic arts installations. He is a graduate of Rutgers University and has undertaken subsequent studies relating to his work in the engineering & installation of metal finishing equipment.

Davis-K Moves

Davis-K Products Co., manufacturer of precious metal plating solutions,

has announced the removal of its factory and offices to new and larger quarters at 135-141 West 29th St., New York, N. Y. The new telephone number is Longacre 4-1978.

Cowles Promotes Clabaugh

Carl C. Clabaugh of the Metal Cleaner Department of *Cowles Chemical Co.*, Cleveland, has been promoted to the newly-created position of sales manager of that department, *Earl F. Clark*, manager of the department announced recently.

Carl C. Clabaugh

Mr. Clabaugh, who has been associated with the firm for 2½ years, has been assistant manager of the Metal Cleaner Department for the past year. The newly designated position will give him full authority, in the field, to make decisions dealing with department personnel and policies.

After attending Michigan State College, Mr. Clabaugh served as a chemist for a large electrical products company and was a technical sales representative for a chemical manufacturer before joining the company early in 1952.

Mr. Clabaugh and his wife, Karlene, make their home in Warrensville Heights, a suburb of Cleveland.

Detroit Man Named Sales Engineer for Udylite

Jack H. Senger has been appointed a sales engineer in the Detroit area, it is announced by *Howard J. Ward*, Michigan district sales manager of the *Udylite Corporation*. Senger has been with the company for a year and a half as a salesman in the Plastics Division.

Previous experience included supervision of machine and conveyor layout engineering at Sherwood Industries, Detroit, and selling for the Dysen Co., also Detroit. He will service the area from the Detroit office at 1651 E. Grand Boulevard.

Jack H. Senger

Ellis Allen Co. Acquires Glover Coating Co.

Manson Glover has anounced the acquisition of *Glover Coating Co., Inc.* by *Ellis Allen Co.* of Woburn, Mass., manufacturers of rubber-covered rolls and molded rubber goods.

Mr. Glover continues as president of the company and *John A. Chew*, president of Ellis Allen, has become treasurer of Glover Coating. Administrative

Manson Glover

John A. Chew

offices of the two companies are at 5 Conn Street, Woburn. Plant operations continue at Malden, Mass., under the direction of *William W. Stasioswki.*

Electroplating Story to Appear in Popular Magazine

Science Digest, a popular pocket type magazine, widely circulated throughout the United States and Canada, has scheduled for publication in its September or October issue, a human interest article about electroplating. The article, *"The Magic of Electroplating,"* which was written for the monthly by *Joseph B. Kushner*, director of the *Kushner Electroplating School* of Stroudsburg, Pa., gives in popular terms, the story of electroplating and explains to the lay reader what an electroplater does and what he is responsible for. Most laymen have little knowledge of the electroplating industry, its size and scope. There has been a definite need for articles which will publicize the industry and tell the electroplating story in popular terms. "The Magic of Electroplating" does just this. The experienced plater as well as the layman will find many of the facts and anecdotes contained in the article, of considerable interest. Science Digest is available at all newsstands.

Essak Steel and Chemical Co. Appoints R. W. Kress & Co. as Its Representative

Henry Essak, president of *Essak Steel and Chem. Co.*, 4013 Milwaukee Ave., Chicago, Ill. has announced the appointment of the *R. W. Kress & Co.*, 21777 Cromwell Ave., Cleveland 26, Ohio as sales representatives for the northern half of the state of Ohio. This appointment is in line with Essak's current policy of widening distribution in various industrial areas. The Kress organization is well known and well respected in the metal working trade and will now be able to render an additional service to their customers by supplying a complete line of metal cleaning products as well as technical assistance in processing.

Magnus Appoints Robert L. Kaiser

Magnus Chemical Co., Inc., Garwood, N. J. has appointed *Robert L. Kaiser* as marketing development manager. He will concentrate on sales

planning, training, and sales promotion coordination.

Mr. Kaiser holds an A. B. degree in Economics from Dartmouth College, from which he graduated Phi Beta Kappa and second in his class. Prior to five years as a Field Artillery officer in World II he was with N. W. Ayer & Son, advertising agency.

Since 1946, Mr. Kaiser has managed the Dif Corp., manufacturer of consumer cleaning specialty products and closely affiliated with Magnus. He is now executive vice-president and general manager of the Dif Corp. and the Larkin Soap Co., wholly owned subsidiary of Magnus. Mr. Kaiser will continue in these positions with Dif and Larkin in addition to taking on his important new job in Magnus.

Robert L. Kaiser

Gordon Hall

Hall Joins Austin F. Fletcher, Inc.

Gordon Hall, formerly with Wollensak Optical Co., Rochester, N. Y., is now associated with *Austin F. Fletcher, Inc.*, Binghamton, N. Y. Mr. Hall becomes resident sales and service engineer for the Rochester area. His appointment will make available to this area complete service in metal finishing.

Moore Appoints Ohio Representative

Robert H. Galambos, 601 Forest St., Bay Village, (Cleveland) Ohio, has been appointed as sales engineer for Ohio, accordingly to a recent announcement of the *John B. Moore Corp.* of Nutley, N. J. Mr. Galambos was formerly with American Mineral Spirits Co. in both Northern New Jersey and Philadelphia. Servicing of the company's growing Ohio sales is to be handled from warehoused stocks in both Pittsburgh, Pennsylvania and Detroit, Michigan. The John B. Moore Corporation specializes in the formulation and application engineering of "Solvents Engineered for Safety" in industrial process and maintenance cleaning.

Goodsell Promoted by Minnesota Mining

Promotion of *Clare W. Goodsell* to

automotive trades manager of the coated abrasives and related products division was announced recently by *Minnesota Mining & Manufacturing Co.*

Goodsell joined 3M in 1938 as a salesman in Omaha, Neb. In 1940 he was promoted to distributor trades sales manager in the Chicago area and in 1946 he became combined trades sales manager in the Detroit division. Since 1949 Goodsell has been automotive trades sales manager in the Detroit division.

He replaces *Kenneth J. Shea* who has been promoted to vice-president of sales for the International dviision.

Goodsell will make his headquarters at the firm's general offices in St. Paul.

Adolph Plating, Inc., Acquires Advance Tinning

Robert L. Giesel, president, *Adolph Plating, Inc.*, Chicago, has announced the acquisition of the assets of *Advance Tinning Co.*, also of Chicago.

The firm will continue its hot-dip tinning operations under Giesel's management without change of personnel or facilities. *Carl F. Hansen*, formerly president of Advance Tinning, will continue to be associated with the company as technical consultant.

Giesel is vice chairman of the *Chicago Electroplaters Institute*, and chairman of that group's Industrial Relations Committee. Hansen is a former chairman of the Institute and is currently a member of its board of directors, and is secretary-treasurer of the *National Federation of Metal Finishers*.

American Nickeloid Opens Philadelphia Office

American Nickeloid Co., Peru, Illinois, manufacturers of pre-plated metals in sheets and coils, announces the opening of a Philadelphia sales office in the Western Saving Fund Building, Broad and Chestnut St., Philadelphia 7, Pa. The new office was established, according to *Carl C. Struever*, general manager of the company, in the interest of better service to the firm's customers in that area. Simultaneously, the firm revealed that it has closed its Detroit sales office.

Marc F. Hermann, the company's former representative in Detroit, is in charge of the new office. Mr. Hermann has been with the company since 1938 and has worked out of both the New York and Detroit offices.

Telephone number of the Philadelphia office is Pennypacker 5-1314.

H-VW-M Makes New Sales Appointments

Hanson-Van Winkle-Munning Co., manufacturer of plating and polish-

C. E. A. Solla

ing equipment and supplies, has announced new appointments in Ohio and Massachusetts. *Calvin E. A. Solla* is the new district manager for Ohio, and *Hilton M. Smith* is sales representative for the Boston area.

Solla was salesman for the firm in the Boston area for 2½ years. In his new assignment he will cover North-Central Ohio himself, and direct activities throughout the state from his new Cleveland headquarters. A member of the American Electroplaters' Society, he is an engineering graduate of Lafayette College.

H. M. Smith

Smith, who joined the firm in January of this year and has been undergoing training, will cover Rhode Island, Eastern Massachusetts, New Hampshire and Maine. Previously he had six years of sales experience. A graduate of New Jersey State Teachers College, he has taken post-graduate studies in chemistry at Monmouth Junior College and Rutgers University.

Hermanson Introduces Grind-O-Flex to Sales Representatives

Ray Hermanson, vice-president in charge of sales for *Merit Products, Inc.*, of Culver City, Cal., is making an extensive trip through the industrial areas of the Midwest and East to confer with sales representatives on the Grind-O-Flex flexible grinding wheel recently introduced by the company. He plans to hold sales conferences in key cities where he will demonstrate the new wheels' applications for light grinding and polishing. Hermanson will appoint agents in areas where representation is presently limited. Returning to Southern California the latter part of July, he will devote his attention to distribution on the Pacific Coast.

Minnesota Mining Appointments

Appointment of *George J. Wachholz* as controller has been announced by *Minnesota Mining & Mfg. Co.*

In this new capacity Wachholz will be responsible for the preparation of budgets and supervision of operating accounting controls and procedures for 3M divisions and domestic subsidiaries.

He joined the company in 1936 as a cost accountant and was later made division controller. In 1950 he was appointed assistant controller. Wachholz is a past president of the Twin City chapter of the National Association of Cost Accountants and is currently a member of the national research committee of the NACA. He is also a member of the Controllers Institute.

For the past two years he has been a member of the advisory committee on school accounting and budgetary

procedures for the St. Paul public schools.

Election of *Edward R. Newcomb* to vice president of export sales of the International division was also announced by the board of directors. His new responsibilities include export sales to Japan, the Phillippines, South Africa and Latin American countries.

Newcomb joined the company in 1950 as a special sales representative to the railroad industry. In 1951 he was transferred to the International division, becoming export sales manager in 1953. Before joining 3M, he was sales manager of the Durex Abrasives Corp.

He will continue to headquarter in the International division's New York export sales office.

Rubinstein Reopens Office

Since returning from a survey of overseas metal finishing plants, *Marvin Rubinstein*, Metal Finishing Engineer, has reopened his office for consultation to the metal finishing field. He now maintains office facilities at 240 East 22nd St. in New York City and office and laboratory facilities at 915 West-

Marvin Rubinstein

chester Ave., Bronx 59, N. Y. His telephone number is LUdlow 9-3500-01.

Mr. Rubinstein, who has been a frequent contributor to METAL FINISHING, will specialize in maintaining contacts and liaison between U. S. suppliers and finishing plants and their European and Middle Eastern counterparts. His firm will also give complete service in plant layout and installation and inservicing and troubleshooting. An information and employment contact service for the industry will also be implemented in the near future.

Allied Research Appoints Borell Pennsylvania Representative

Allied Research Products, Inc., manufacturers of the Iridite line of chromate conversion coatings for non-ferrous metals and ARP plating chemicals, has announced the appointment of *Phillip Borell* as its representative in the Eastern Pennsylvania and adjacent New Jersey area. Mr. Borell will make his headquarters at Room 1123, Western Saving Fund Building, Broad and Chestnut Sts., Philadelphia, Pa. *Dean Ward* continues to handle the major New Jersey territory. Both report to the Baltimore Home Office.

J. A. Cairns has moved to the home office of the corporation to handle special project sales.

Pennsalt Appoints Burford District Sales Supervisor

Robert M. Burford has been named sales supervisor of the newly created Buffalo district for the Metal Processing Department of the *Pennsylvania*

Salt Mfg. Co., it was announced by *J. J. Duffy, Jr.*, sales manager.

In his new position Mr. Burford will supervise sales and service activities for Pennsalt metal cleaners, Fosbond phosphate coatings, and Fos Process lubricants for cold metal working. His territory will include New York state, eastern Ohio, northeastern Pennsylvania, and northern New Jersey.

Mr. Burford, a chemical engineer, attended the University of Pittsburgh and joined the sales staff of the company's Special Chemicals Division in 1947. Covering at one time or another all territories included in the Buffalo district, Mr. Burford is well-known to the metal working industry.

SPS Appoints Hambrecht Finishing Division Head

Walter W. Hambrecht, a veteran of 18 years with the *Standard Pressed Steel Co.*, has been made manager of the Finishing Division for the Jenkintown, Pa., fastener and shop equipment manufacturer. He was formerly assistant to the supervisor of form and

Walter W. Hambrecht

finish and, in his new post, has charge of all hand machines, of drilling and grinding and of the rolled thread and plating departments.

Hambrecht was born in Camden, N. J., and educated at the Hatboro (Pa.) High School and at the Pennsylvania State University. He went with the company in 1936 as a milling machine operator.

Progressively he has been an expediter, chief of the maintenance department, which he organized, head of the tool room and night superintendent of form and finish. He was made assistant to the supervisor of form and finish in 1953.

Hambrecht is married, has three boys and two girls and lives at 621 Crescent Ave., Glenside.

Second Big Expansion in Four Years Begun by Stokes

Rapid growth of the markets for its equipment, has led to the second large-scale plant expansion within four years for the 60-year-old Philadelphia manufacturer.

F. J. Stokes Machine Co. has launched a $1 million expansion program that will enlarge its production facilities by another 40 per cent. President *Francis Dougherty, Jr.*, announced recently. The new program follows closely an expansion of about the same scale which was completed early in 1951.

Ground will be broken on July 4 for a 50,000 sq. ft. addition to the present

plant at 5500 Tabor Road, in Northeast Philadelphia, which will provide additional manufacturing space and larger office and engineering department accommodations. Erection of steel is scheduled to begin by early fall and the new building is due to be completed by the end of the year.

Parker Expands

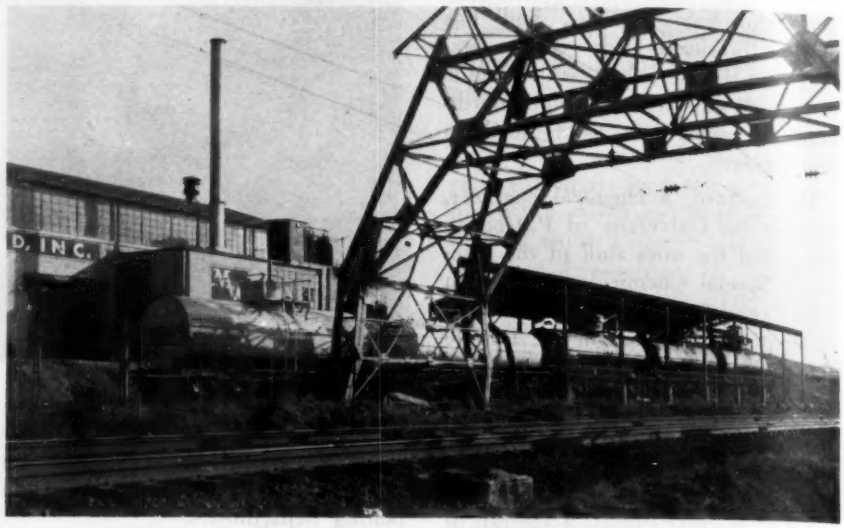
A major expansion, the third within a four year period, is underway at the *Parker Rust Proof Co.* in Maywood, Cal. Mac Isaac and Menke Co., General Contractors of Los Angeles, is handling construction, equipment setting and extensive pipework.

Increased storage facilities for raw materials and finished products, a 20% increase in manufacturing capacity, and added operating efficiency and safety for employees will result when the project is completed.

Raising 1,200 sq. ft. of the main factory building roof a distance of 5 feet will provide sufficient head room and clear story elevation to accommodate the installation of a mezzanine laboratory. Tank storage is being greatly increased by new equipment and by relocation of existing tanks to a new building being constructed.

Movement of the older tank was accomplished without loss or delay in plant output by equipment setting and pipework specialists from Mac Isaac and Menke Co.

Railroad Siding for Lining Tank Cars



A 40′ x 120′ shed has just been completed over the railroad siding at the Scotts Lane Plant of the *MW Protective Coatings Division, Metalweld, Inc.*, Philadelphia, Pa.

This new building permits greater efficiency in the application of sprayed zinc and aluminum, baked phenolics, epon, vinyl and rubber linings to the interior of tank cars to protect their contents from contamination.

Equipment for these application procedures includes compressed air, sandblasting, heating and ventilating units.

Manufacturers' Literature

Water Conditioning Data Book

The Permutit Co., Dept. MF, 330 West 42nd St., New York 36, N. Y.

A new edition of the ever popular pocket-size Data Book, No. 2478A, supersedes an earlier volume produced in 1952. Brought up-to-date and completely revised, it presents a compilation of 78 chapters and tables, all valuable to the engineer.

The subjects covered, to name a few, include: hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships, specific gravities, chemical reactions, etc.

This handsome, gold-imprinted, leatherette volume, in the very handy 5 by 7¼ inch size, contains 108 information-packed pages. It is available to practicing engineers and to those who work with water conditioning problems.

Use of Industrial Structural Plastics

Heil Process Equip. Corp., Dept. MF, 12901 Elmwood Ave., Cleveland 11, O.

The above manufacturer announces the availability of a four-page bulletin titled "Chemical-Proof Equipment News."

The bulletin is profusely illustrated with actual fabricated applications of their three newest products: Rigidon, a glass-reinforced plastic; Rigidin, a rigid vinyl plastic; and Rigidene, a polyethelene plastic. These new structural plastics are designed for wide applications in the chemical processing industry and are highly resistant to acid fume and other corrosive conditions.

One interesting application discussed in the bulletin is the use of a solid plastic ventilating system for a steel pickling room. Also included are tank liners, plastic molded anode boxes, molded battery trays, acid tank covers, fume scrubbers, ventilators, hoods and various types of rectangular and round ductwork, special formed or molded equipment.

Productive Maintenance

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new publication, "Five Steps To Productive Maintenance," has been announced as available from the company.

The 18-page bulletin, designated GEA-6087, provides detailed information on organizing to meet the demands that automation will make on an electrical maintenance program. Steps discussed include, (1) Gathering equipment data, (2) Determining extent of routine maintenance, (3) Establishing a routine operating control system, (4) Evaluation for critical maintenance, and (5) Establishing a critical maintenance program.

Baskets, Tanks and Trays

Wiretex Mfg. Co., Inc., Dept. MF, 40 Mason St., Fairfield, Conn.

The new catalog illustrates the wide variety of wire mesh products made by the firm in every size, mesh and alloy. Included in the catalog are sections on baskets, processing and heat treating equipment, fixtures and crates,

tanks, plating and special equipment.

The company maintains a large stock of all types of raw materials on hand so as to meet the most exacting specifications of industry. Among metals and alloys kept in stock are nickel chrome, stainless steel, aluminum, Monel, Inconel, steel, copper and brass.

Industrial Protective Coatings

Ceilcote Co., Dept. MF, 4908 Ridge Road, Cleveland, O.

The above company has announced the publication of the new 8-page illustrated catalog No. C-150, entitled "Protective Coatings by Ceilcote." Purpose of this publication is to simplify the complex problem of selecting the correct protective coating for various industrial installations. Because the company recognizes the fact that no single coating provides maximum protection in every application, it offers a complete line for a wide range of service conditions. Complete data on nine different coatings are presented in the catalog to assist the user in the selection of the one best suited to any individual application.

Information given on each coating includes base formulation, temperature resistance, abrasion resistance, chemical properties, adhesion, method of application, surface preparation, colors, etc. In addition, applications are discussed in detail, and important limitations are noted.

A special feature of the catalog is the protective coating properties chart which presents complete information on each coating in concise form. In addition to formulation, temperature resistance, drying time, coverage, etc., the ability of each coating to resist eighteen commonly encountered chemicals is indicated. The outstanding properties of six frequently used primers are presented also.

Buff Catalog

Joe-D Buff Co., Dept. MF, Sandwich, Ill.

Just off the press, a handsomely illustrated catalog shows the complete line manufactured by the above company. Large illustrations bring out all of the important construction details in a wide range of buffs designed for every polishing requirement.

This comprehensive, twelve-page booklet covers three main divisions: sisal buffs, cloth buffs and polishing wheels. The sisal section includes many types of patented bias sisal buffs which offer frayproof, cool running and longer life. Types shown include bias, spoke finger and conventional buffs with fiberboard and steel centers in sisal, sisal-with-cloth and sisal-with-paper. Full disc buffs are illustrated in a wide range of cloths and sewings. A separate section presents polishing wheels in cloth, sheepskin and felt of many contours and cushions.

Platinum Clad Metals

Baker & Co., Inc., Dept. MF, 113 Astor St., Newark 5, N. J.

This new bulletin describes the construction of platinum-clad equipment produced by the manufacturer. It also details the methods used for testing the coating, and available sizes of tubing, wire, anodes and the operating conditions.

Maintenance Cleaning Guide

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

How-to-do-it charts based on actual in-plant maintenance procedures are

a feature of the new "Plant Maintenance Cleaning Guide" recently published by the above manufacturers of industrial cleaning and related materials.

Designed for quick reference, the charts list recommended cleaning materials, methods of application, concentrations and temperatures for such specific operations as cleaning, and treating the water in, air conditioning and refrigeration units; cleaning compressors and condensers; descaling diesel water jackets and water-cooled furnaces; cleaning floors, oil heaters and coolers, windows and light fixtures; controlling mold and odors; stripping paint from machinery and transformers; and removing rust. The booklet also describes cleaning materials, solution-lifting steam guns, and the Oakite hot spray unit.

Asphaltic Mastics

Emjay Maintenance Engineers, Dept. MF, 327 Union Ave., Rutherford, N. J.

A 12-page reprinted article discussing the composition and recommended applications of asphaltic mastic protective coatings is offered by the company. The illustrated article gives an exhaustive description of the chemical and physical properties of mastics and an explanation of surface preparation and the proper methods for applying asphaltic mastics. Four pages of graphs clearly indicate the degree of chemical resistance exhibited by asphaltic mastics when immersed in solutions of over 150 chemical substances in common use. Photographs of typical mastic-coated industrial structures are also included.

Seven Rules to Select Safe Solvents

John B. Moore Corp., Dept. MF, Lee Building, P.O. Box 3, Nutley 10, N. J.

"An approach to Solvent Safety" is the subject of an address given to safety engineers of the electric power industry. Non-proprietory in nature, the problem of finding the right solvent for the jobs that must be done is shown to be capable of easy analysis and sure control by application of seven rules of measurement to solvent qualities.

Although the discussion uses the electric power industry illustratively, it is evident that the approach is basic to all industries. By demand, the talk has been made available in a four-page pamphlet.

Plating Racks and Tips

Naraco, Dept. MF, 1109 Stewart Ave., Flint, Mich.

The above manufacturer of racks and fixtures, has just released a free 24-page catalog in answer to increasing demand for a ready source of information on racking methods and tip constructions for plating and finishing. The book is planned to acquaint the reader with fundamental tip, or work holder, forms and basic racking procedures. It is meant to constitute a background for suggesting the correct approach to any specific problem.

Grinding Wheels

Norton Company, Dept. MF, Worcester 6, Mass.

A new 28-page catalog, 174-8, describing its reinforced resinoid line of grinding wheels has recently been issued by the company.

This liberally illustrated booklet contains typical application photographs, tables of wheel sizes, prices, operating speeds and other data.

Scores of portable grinding operations are listed together with the recommended wheel specification.

Wheels discussed in this booklet are the BN type straight cutting off wheels for removing gates and risers, slotting and cutting firebrick; BD type hub wheel for weld grinding, cleaning castings, removing rust; BFR type reinforced hub wheel for work requiring flexibility for removing mold marks on castings, smoothing welds on auto bodies, preparing cast surfaces for painting and removing rust; and the BF reinforced straight wheels for deburring, removing flash from plastic parts, removing marks from turned parts, and miscellaneous light portable and bench grinding operations.

Plating Rectifiers

Ther Electric & Machine Works, Dept. MF, 17 South Jefferson St., Chicage 6, Ill.

A new 8-page, 2-color, illustrated bulletin (No. 5,500) contains helpful hints on installations of plating rectifiers, describing different arrangements best suited for certain installations. Descriptive photographs are included to demonstrate the different arrangements. Valuable information concerning the desirable features of top quality rectifier construction is outlined in detail. It shows the new dripproof laboratory models together with a complete description of the other various types of rectifiers that are available for electroplating and anodizing. The bulletin also gives a brief discussion of the history and present facilities of the firm.

Degreaser Operating Manual

Manufacturers Processing Co., Dept. MF, 1360 Hilton Road, Detroit 20, Mich.

"Vapor Degreasing Do's and Don'ts" is the title of a manual, recently issued, showing proper degreaser operating methods.

The new manual treats the subject of vapor degreasing with brief text and a profusion of illustrations. This literature covers every phase of metal cleaning through vapor degreasing, including safety, personnel, correct layout and maintenance of equipment, efficient operations, drainage, machines, and chemicals. Each phase is illustrated pictorially showing the "right" and "wrong" methods.

Furan Base Coatings

Carboline Co. Div., Mullins Non-Ferrous Castings Corp., Dept. MF, 331 Thornton Ave., St. Louis 19, Mo.

A four-page 2-color bulletin, No. 400, now describes a recently introduced Furan flexible coating (the only coating of its kind). It is unplasticized and available in a limited range of colors. Application is similar to that required by vinyls but resistance to acids, alkalies and solvents is materially greater.

This coating is prepolymerized and completes its polymerization, after application, without addition of a catalyst. Coating thickness is 2 to 3 mils (.002" - .003") per coat and impermeability of film is excellent.

The new bulletin covers:

Application to most types of surfaces, including rusty steel.

Technical explanations of film polymerization.

General corrosion resistance.

Distinctive features and uses.

Vinyl Coatings

Carboline Co. Div., Mullins Non-Ferrous Steel Castings Corp., Dept. MF, 331 Thornton Ave., St. Louis 19, Mo.

Considerable basic data on vinyl coatings, not available in other commercial literature, is given in a new bulletin, No. 200, on Polyclad Protective Coatings.

This bulletin covers five types of vinyls, with complete primer requirements for all types of surfaces, including rusty steel and old coatings.

These vinyl coatings are recommended for maintenance painting, sealing over non-continuous surfaces, enveloping equipment with a continuous sheathing, (temporarily or permanently) and for lining steel and concrete tanks.

Mentioned are new high solids vinyls which have been applied by professional coating applicators in films as heavy as 5 mils (.005") on vertical surfaces.

This new bulletin is particularly valuable for its general information and the clarity of distinction between various vinyl formulations. Pertinent facts are given on use, temperature limitations, coating thickness and coverage, relative weathering ability and cost.

pH Electrodes and Assemblies

Leeds & Northrup Co., Dept. MF, 4907 Stenton Ave., Philadelphia 44, Pa.

A new catalog, EN-S5, describing "pH Electrodes and Electrodes for Measuring Redox Potentials — Assemblies, Parts and Accessories," has been published, covering the complete L.&N. electrode line, chemicals for electrode servicing, and auxiliary electrode equipment such as clamps, holders, thermometers.

Primarily, however, it is designed to present electrode assemblies for measurement, recording, and/or control of solution pH and redox potentials, and should be of major interest to production and research men engaged in this work.

Quick-Seal Hose Coupling

Industrial Sales, Titeflex, Inc., Dept. MF, Hendee St., Springfield 4, Mass.

A quick connect-disconnect hose coupling for water, oil, steam, gas and chemical lines, which provides permanent freedom from leakage, is described in a bulletin just published.

Entitled "Titeflex Quick-Seal Coupling," the 16-page booklet describes the simple construction of the coupling and points out how this construction provides:

1) A unique sealing action which makes the coupling tighter as internal pressure increases, thereby insuring freedom from leakage, even at high pressures.

2) A full swiveling action that prevents hose twisting and kinking, thereby insuring long hose life.

Also described in the bulletin are single- and double-check valve modifications of this coupling which: 1) permit disconnecting lines without shutting down pumps; and 2) prevent escape of valuable or hazardous fluids when lines are opened. Coupling accessories, such as right-angle connections and dirt-exclusion covers are also described.

A list of users indicating the industries in which the coupling has been applied; a table of pressures at which

it can be used; tables of the materials and sizes in which the coupling is manufactured, and instructions for ordering are also included in the bulletin. In addition, the bulletin lists the company's regional sales offices through which this coupling will be marketed throughout the United States.

Organic Protective Coatings

Carboline Co., Div., Mullins Non-Ferrous Castings Corp., Dept. MF, 331 Thornton Ave., St. Louis 19, Mo.

Sixty different coating systems, applied on rusty steel panels, were tested in a chemical plant and scored for appearance, adhesion, creep corrosion and edge protection. Panels were suspended outside in a 7% sulfuric acid mist at 130°F. developed by acid flowing over a weir. Temperatures ranged from 20°F. to 95°F. Both primer and finish coats are grouped for ready comparison in Bulletin No. 121.

The tests covered Federal specification primers, phenolic primers, alkyd primers, wash primers, fish oil, Hycar and many others. The finishes tested were rubber base, vinyl, mastics, polyvinylidene chloride, polystyrene, epoxy, methacrylates, polyester and neoprene.

The data shows quite conclusively that both primer and finish selection are important when painting rusty steel in corrosive atmospheres. The vinyls as a class were good, equalled or excelled only by neoprene, some methacrylates and a special unplasticized, flexible furan coating.

Wiping Cloths

Charles Belsky & Sons, Inc., Dept. MF, 532 Main St., Holyoke, Mass.

A long needed development is filled in the publication of a wiper quality chart. By means of this copyrighted chart, twenty-one basic types of cloths are scientifically analyzed and compared with regard to their important wiping qualities. Absorbency, lintlessness, softness, durability, weight of fabric, color, type of fabric, weave, shape and size are all wiping characteristics given measurement in this interesting and helpful new chart. It has already helped many concerns to obtain the particular wiping cloth best suited to their needs.

Water and Waste Treatment

Hall Laboratories, Inc., Dept. MF, Hagan Building, Pittsburgh 22, Pa.

The highlights of 30 years devotion to solving problems related to the procurement, treatment, use and disposal of industrial water have been condensed into a new 10-page booklet, "What Is Hall Laboratories?"

Briefly touching on production problems in steel, textile, chemical and metal plating plants, plus a paper mill and a refinery, the new literature reports on tracing the cause of troubles to the industrial water system between its source and its final effluent.

The booklet reviews the continued progress of the company in making industrial water behave. It scans the work of their field engineers in district offices and presents the facilities of its service laboratories.

Final pages in the booklet tell of the operations specialists in water management and the process industries specialists of the firm who are available to originate water treatment procedures and to undertake investigations when trouble threatens.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Morrison Named Editor of Plating

Lee H. Morrison of New York has been named editor of the national magazine *Plating*, succeeding *Alexander L. Korbelak*, it was announced by *P. Peter Kovatis*, executive secretary of the *American Electroplaters' Society*, publisher of the monthly. Morrison's appointment is effective with the August issue of the magazine.

Morrison joins the publication with more than twenty years of editorial experience. He has engaged in newspaper, magazine, and book publishing, as well as public relations and publicity.

He was formerly director and editor in chief of Avery Press, a New York book publishing firm. He also served as editor at International Correspondence Schools, Scranton, Pa.; editor at the Columbia University Press, New York; editor of Public Utilities Fortnightly, Washington, D. C.; editor of Mexican Commerce and Industry, Mexico City; and editor of the Monterrey Times, Monterrey, Mexico.

Lee H. Morrison

A veteran of World War II, he served with General Patton's Third Army and later with General Patch's Seventh Army in the European Theater. After the war he served in the occupation of Germany and with the American Military Mission to Greece.

Morrison is a graduate of Columbia University, New York.

San Francisco Branch

Jack Raskin of Los Angeles, west coast supervisor of the metal finishing division for the L. H. Butcher Co., was the principal speaker at the last meeting of San Francisco Branch.

Mr. Raskin pointed out the tremendous problems which the nickel shortage has placed on the plating industry and intimated that there was no immediate relief in sight. His talk also embraced such phases of operation as automatic plating, abrasive tumbling and high speed nickel baths.

Following the conclusion of the formal talk, Mr. Raskin and *Fred W. Huntington*, chairman of the Branch's board of managers, served as moderators over a discussion dealing with the use of PR units in nickel baths. The forum also discussed the use and importance of plating tanks, nickel storage tanks, problems concerning the undercoatings on automobile bumpers,

and the use of polysulphide for purifying zinc solution.

President *Edward Kettman* named the following membership and attendance committees: Membership — *J. R. Pattenger, Fred W. Huntington, Floyd Browing* and *Howard Lackey, Jr.* Attendance — *Robert Hart, Mark Crow, Bert Trygstad, Jack Ulrich* and *Ray Hefner*. The plan is to assign to each committee member a certain number of members whom they will phone prior to each monthly meeting in order to urge attendance.

News from California

By Fred A. Herr

Alert Supply Co. of Los Angeles announces the opening of a Pacific Northwest Branch, with headquarters at 5201 First Avenue South, Seattle, Wash. *Arthur S. Krause*, who has had many years experience in practical plating shop operation as well as in the equipment sales end of the industry, has been named branch manager.

Krause was formerly plating superintendent for the Riverdale Metal Finishing Co. in Chicago, and served with the A. G. Smith Co. of Toledo, O., and a number of other prominent middle-west firms before moving to the Northwest several months ago. He will supervise sales activities in Washington, Oregon and Vancouver, B. C.

Arthur D. Gaskin of Alert Supply Co. also announced that his firm has been named representative on the Pacific Coast for Engelberg-Huller Co., Inc., of Syracuse, N. Y., to represent it in the plating field in the sale of the Porter-Cabler, a belt polishing machine, and other items in the Engelberg-Huller line. This supplements a wide variety of nationally known products distributed by the company.

Parker Rust Proof Co. of Maywood, Cal., has work under way on an expansion program which provides for increased storage facilities for raw materials and finished products, and a 20 to 25% increase in production capacity.

Precision Sheet Metal Co. of Los Angeles has come up with an ingenious conversion of a fixed conveyor line into a mobile unit for spray painting metal parts.

The conveyor was originally designed for a special long run job in which component parts were conveyed through a high temperature oven. After the completion of that job, the company decided to convert the conveyor for other purposes. This took the form of mounting the conveyor mechanism on uprights, rigidly cross-braced, and attaching casters to the bottom. In its converted form the conveyor, which is 20 feet long, serves as an ideal mobile framework for spraying parts in that it can be wheeled into various departments: The fabrication department where the parts are attached; then into the spray booth, and from there, with the parts still attached, into the drying room.

Hexcel Products Co. of Oakland, Cal., has franchised Seaporcel Metals, Inc. of Southern California to manufacture its architectural porcelain enamel, Hexcelite, a new glass-aluminum honeycomb sandwich used in building construction. The product is an aluminum honeycomb core, faced on both sides with glass, and held together with a bonding resin. Seaporcel Metals manufactures porcelain enamel for commercial and public building uses and for industrial plants.

Engineers of the Lockheed Aircraft Co., Burbank, Cal., have originated a novel traveling paint booth whichh reportedly cuts five days off the production time for Super Constallation airliners. The booth is suspended from an overhead crane and can be moved back and forth above the fuselage of a plane, or from plane to plane in the line, as production progresses. The shop crews call it the "howdah" (after the canopied seat in which potentates ride on elephants). Painters inside the suspended booth can spray the plane while assembly work continues on other parts. The booth is equipped with special air conditioning and fire safety facilities. Formerly it was necessary to move planes from one building to another for painting.

A Quality Control Show held recently in the Embassy Auditorium, Los Angeles, under the auspices of the Paul B. Slater Co. of Los Angeles, attracted approximately 1,000 western plant executives and quality control engineers.

The Materials Handling Division of the Magnesium Co. of America, whose headquarters are in East Chicago, Ind., has moved western sales offices from San Francisco to Ei Segundo, Cal., where quarters have been made available in the building of the recently acquired Tobey Aluminum division. *George Hajack* is western division sales manager.

The Los Angeles Paint & Varnish Production Club had its annual summer party for members, their ladies and guests scheduled at the Huntington Hotel, Pasadena, for the night of August 7. The program was divided into a social hour beginning at 7 p.m., courtesy of the raw materials group of the club; dinner at 8 p.m. in the Pool Gardens, an outdoor dining room adjacent to the swimming pool; and dancing from nine till midnight. *Al Abshire* and *Robert Dorsett* made the arrangements. Officers of the club are: President, *G. W. Venatta;* Vice-President, *W. Vern Barrett;* Secretary, *I. D. J. Heisler;* and Treasurer, *Joseph L. Mattson.*

In order to provide Southern California facilities for supplying the trade with proprietary solvents and denatured alcohol, Shell Chemical Co. has acquired the inventories, warehouses and alcohol manufacturing plant of Las Chemicals, Inc., at Culver City, Cal. The plant complements denaturing facilities Shell already has in operation at Houston, Tex., Chicago, Ill., and Sewaren, N. J.

R. G. Boyd, assistant general sales manager of Kaiser Aluminum & Chemical Sales, Inc., Oakland, Cal., has been granted a leave of absence to serve as director of the Aluminum-Magnesium Division of the Depart-partment of Commerce Business and Defense Service Administration.

Los Angeles

With the western metal working in-

dustry, including fabrication, processing, forming and finishing, having attained the stature of a 4½ billion dollar industry, the first annual Western Plant Maintenance Show and Conference, held at Pan Pacific Auditorium, Los Angeles, Cal., July 13 to 15, presented a timely opportunity for study of the maintenance problems in all their aspects as they apply to the rapidly growing western metal working industry.

The show and conference focused attention on and dealt with the problems of a wide variety of industries, from aviation to zinc coatings, from electrical maintenance to tool preservation. The varied exhibits and conference talks included such subjects as cleaning and corrosion prevention in industrial tanks, spray booth maintenance, general protective coatings, spray lubrication, instrument checking, etc.

A total of 130 exhibitors presented their products in 144 booths, among which manufacturers and suppliers of equipment and products for finishing and protection of metals were well represented. Among these latter which sponsored booths, and the products they displayed, were the following:

Turco Products, Inc. Displayed in this booth were nine specialized paint spray booth maintenance products.

Insul-Mastic Corp. of America: Models of Tanks and structures were displayed showing coatings in use in the four categories of corrosion prevention, vapor and weather sealing, waterproofing and insulation.

Oakite Products, Inc.: This firm displayed a new device for cleaning industrial tank interiors, designed to clean tank trucks, or cars and tanks up to 50 feet in diameter and 25 feet high. The firm also displayed its new rotary sprayer and solution-lifting steam detergent guns.

Rust-Oleum Corp.: A large mobile display presented methods of applying the firm's products over rusted surfaces. Literature on the company's entire line of plant finishes was available.

General Electric Co.: The GE booth featured protective maintenance with emphasis on planned overhaul. The company's Los Angeles service shop exhibited a service shop operation for repair of small motors and electrical equipment. Testing instruments, leak detectors and panel instruments were shown.

Commercial Filters Corp.: Displayed were representative models of industrial filters.

Vacu-Blast Co., Inc. exhibited blast cleaning equipment.

Inertol Company, Inc. displayed a line of paints and protective coatings for general industrial use.

A two-day maintenance conference was held concurrently with the show. A general session was held in the morning and afternoon of July 13 at the Ambassador Hotel, Los Angeles, with sectional conferences in the afternoon of July 13 and the morning of July 14.

L. C. Morrow, consulting editor of *Factory Management and Maintenance*, was general chairman of the conference, at which such subjects at the following were discussed: Maintenance in Metal working Plants: Principles of Maintenance Organization and Management; Planning and Scheduling Maintenance Operations; Inspection Procedures and Frequencies; and maintenance in the electrical equipment, aircraft, food processing and petroleum processing plants. Each talk was presented in the form of a forum discussion, with a discussion leader assigned to direct question and answer periods.